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INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

SCHOOL SHOP ANNUAL

The Shop Teachers' Professional Magazine

HOW THE INVISIBLE PIERCES THE IMPENETRABLE AND

UNVEILS ITS SECRET

Black light, the invisible emanations of ultraviolet rays, played upon precious things hitherto shadowed and concealed from man's searching scrutiny, causes them to reveal themselves in softly radiant colors. Under this black magic, metal-bearing rock and petroleum-bearing water seepage shine opalescently; the greenly glowing lips and eyes of an apparently dead soldier hero tell of a faint flicker of life; thus valuable deposits of minerals and oil are discovered, many lives are saved.

Here is an analogy pregnant with meaning for educators. Similarly can the invisible light of their intelligence and insight play upon the lads in their classrooms, piercing the obscuring and misleading personality traits of these boys to the sterling metal of character and ability beneath, discovering it, causing it to shine and manifest itself in a way that leads to achievement in the classroom and success in later life. Similarly does the intelligence of teachers, renowned for the high level of classroom attainments they evoke from their students, single out and apply the subtle influences that can awaken the slumbering ambition and mobilize the energy of these lads around a high and adult goal. Competent instructors in mechanical drafting, for example, never dull the force that drawing instruments, properly selected, can exert. For fine drawing instruments give pride of possession, play upon a youngster's imagination and fire it into a flame that colors all his work. They give the boy the sense of kinship between himself and men of achievement, inspire him with a sense of emulation in the same way that a fine baseball glove or bat makes its possessor see himself *and act* as a second Babe Ruth or Alexander. Boys are not driven, they must be *inspired* to achieve. The proper selection of drawing instruments when a boy first comes to class is crucial in this process.

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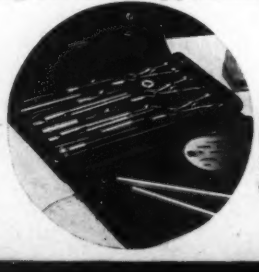

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EVERYTHING FOR DRAFTING AND SURVEYING

SOMERVILLE VOCATIONAL SCHOOL
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Plan Now
TO MODERNIZE YOUR SHOP

Discharged servicemen are already returning from the battle fronts to seek civilian employment. Many will need retraining before they go to work and it is our patriotic duty to give them the best possible instruction on modern shop equipment that is in good serviceable condition.

In most school shops a careful survey will show that much of the equipment has been worn or damaged beyond repair during the strenuous war production training period when over-crowded classes kept machines going twenty-four hours a day.

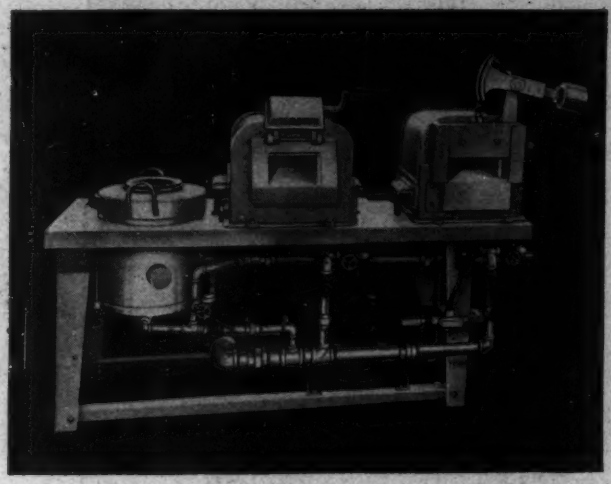
Plans for a complete modernization and replacement program should be made at once so that orders for machinery can be placed now. Although shop equipment has been hard to get during the past few years (most of it going to the armed forces and war production plants) conditions are rapidly improving and orders from educational institutions can now be accepted.

WRITE
FOR THIS NEW CATALOG

Illustrated in full color—showing all types and sizes of South Bend Lathes—Engine Lathes and Toolroom Lathes with 9", 10", 13", 14½", and 16" swings—Precision Turret Lathes with ½" and 1" collet capacity. Ask for Catalog 100-D.

SOUTH BEND LATHE WORKS
466 EAST MADISON STREET SOUTH BEND 22, INDIANA
LATHE BUILDERS FOR 38 YEARS

SUGGESTED STEWART INDUSTRIAL FURNACE EQUIPMENT



STEWART TRIPLE-PURPOSE FURNACES

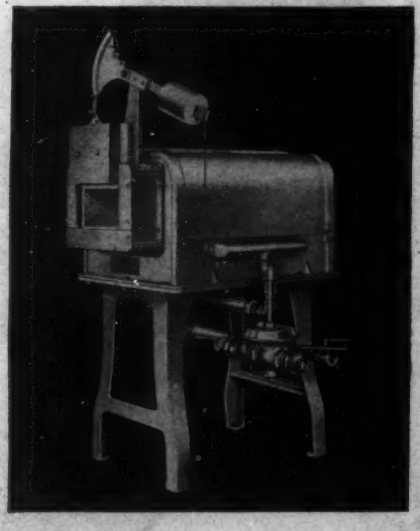
Because of its wide range of usefulness the Stewart Triple-purpose Furnace (E), shown at the left, designed for operation on gas at ¼ lb. pressure and air at 1 lb. pressure, is a basic metalworking unit for school or small shop work. It combines three of Stewart's most popular small furnaces: (1) No. 28 Oven (temperature range 1400° to 1800°), (2) No. 28C Oven (temperature range 1800° to 2400°), (3) B612 Pot Furnace (temperature range 400° to 1600°). To supply the air required, the Turbo-blower shown mounted on the unit has been found most satisfactory. Because of the precise requirements of today's heat treating, temperature-indicating equipment is recommended. A single pyrometer instrument can be used with a thermocouple selector switch, and a thermocouple with lead wire for each of the three furnace sections.

HEAT TREATING OPERATIONS OF THE STEWART TRIPLE-PURPOSE FURNACE

Oven Furnace Hardening Carbon Steels . . . in No. 28 Oven Section.
Lead, Salt or Oil Tempering Carbon Steels . . . in B612 Pot Section.
Oven Furnace Preheating High Speed Steels . . . in No. 28 Oven Section.
Oven Furnace Hardening High Speed Steels . . . in No. 28C Oven Section.
Lead or Salt Drawing High Speed Steels . . . in B612 Pot Section.
Pack Carburizing or Hardening . . . in No. 28 Oven Section.
Cyaniding, Lead or Salt Hardening . . . in B612 Pot Section.
Annealing . . . in No. 28 Oven Section.
Melting Lead, Zinc, Babbitt, etc. . . . in B612 Pot Section.
Melting Brass Bronze, etc. . . . in B612 Pot Section (with crucible).

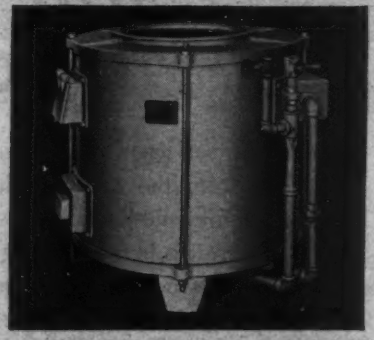
STEWART SMALL SEMI-MUFFLE FURNACES AND ROUND POT TEMPERING FURNACES

(For heat treating larger parts, Stewart small Semi-muffle Furnaces are available with work chambers as large as 6" high x 12" wide x 22" long. These furnaces are the same general design and specification as sections 28 and 28C of the Triple-purpose Furnace shown above.)



SMALL SEMI-MUFFLE FURNACE

Handy, compact general purpose furnaces widely used in small shops, tool rooms, and schools for a wide variety of work such as annealing, carburizing, hardening, and general heat treating. They are quickly brought up to heat, making them particularly desirable for intermittent use. With their standard heavy duty molded linings they are easy to maintain and operate. The large number of burners on gas-fired units firing underneath semi-muffle hearth provide maximum temperature uniformity and production. Available in several standard hearth sizes as large as 12" x 22".



ROUND TEMPERING FURNACE

Following the hardening of the work in the Stewart small Semi-muffle Furnace shown above, the work should be tempered, drawn, or stress relieved in a Stewart Round Tempering Furnace, using oil, lead or salt in the heating bath. These furnaces are available with pots from 12" in diameter to 18" in diameter, and from 12" deep to 20" deep in standard sizes. Standard temperature ranges are 400° to 800°, or 800° to 1200°. Combinations of these ranges are also available.

FOR SCHOOL SHOP METALWORKING REQUIREMENTS

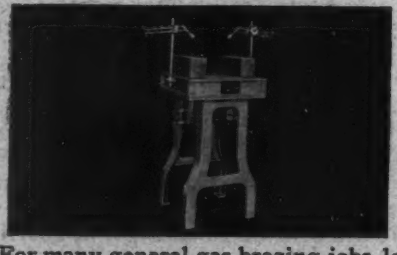
STEWART SMALL FORGE FURNACES

Where training in modern forge practice is given, these small Stewart Forge Furnaces are standard equipment in many technical schools and colleges. They are ideal for general forging, forming, and tool dressing work. Sturdily constructed, and highly efficient in operation, with uniform, quick heats. The linings are simple and easily maintained, yet efficient and enduring. Designed for operation on gas at ¾ lb. pressure only, and also require air at 1 lb. pressure. Since the temperatures at which the operations are done are usually not critical, pyrometer equipment is not required.

STEWART NON-FERROUS METAL MELTING FURNACE

These furnaces are designed for the melting of brass, aluminum, tin, nickel alloys, copper, copper alloys, gold alloys, magnesium, zinc, lead, cadmium, nickel-silver, bronze, beryllium, antimony, etc. Widely used in school and shops for many small casting jobs. The swinging top made of one piece of molded refractory, banded to add strength, lifts easily from the body of the furnace by means of a special mechanism, and swings to one side, giving a clear opening into the body of the furnace—a feature much appreciated at casting time. The linings are of high grade refractory material, sufficiently heavy to resist the abrasive action of the swirling flame which the burners set up. They are available in several sizes, with crucible capacities from 12, 36 and 105 lbs. of brass up. The smallest size is designed for gas only; other sizes can also be supplied for oil fuel. All sizes require air at 1 lb. pressure. Ordinarily no pyrometer or temperature-measuring equipment is required.

STEWART BRAZING TABLE



For many general gas brazing jobs, low temperature welding work, and other school and shop needs, this Stewart Brazing Table has proven very satisfactory in hundreds of installations. The blow pipes are pivoted and hinged so blast may be directed at any angle from either nozzle and concentrated at any spot. Blow pipes can be equipped with special nozzles for specific operations as required.

Get Your FREE Copy of Guide to Furnace Selection

For instruction purposes, copies of the Stewart Guide to Furnace Selection is available without charge to educators. This guide can be used to find quickly the type of gas or oil-fired furnace best suited to any work. This guide is also intended to assist in finding the heating time required, the heating medium to be used, and from these, the type of furnace best suited for a particular heat treating operation with regard for the production required and the weight and size of the material to be heated.

Write: **STEWART INDUSTRIAL FURNACE DIVISION**
of
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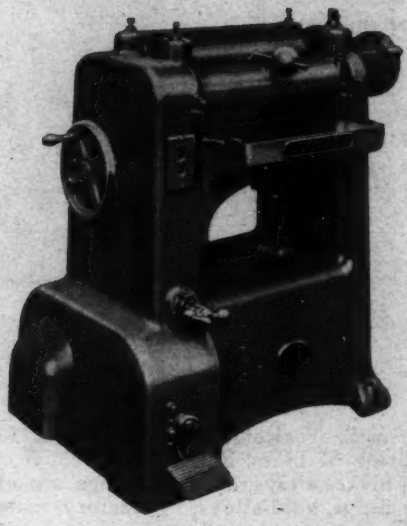
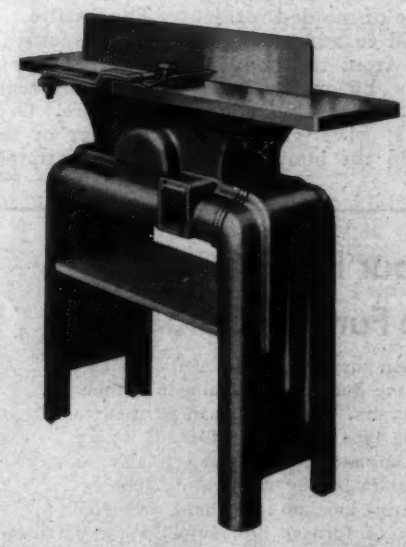


J-18 Single Surfacer — Designed for safety, convenience and for a long, trouble-free life, it is ruggedly built to withstand continued hard usage — has the power and speed to produce a high quality of finish. A casual study of a few of its features, stamps it at once as being a great surfacer: one-piece frame, an unbroken range of speeds from 15 to 45 feet per minute, through a variable speed drive; 3-knife, round, safety-type cutterhead; solid chip-breaker and pressure bar; moving parts enclosed.



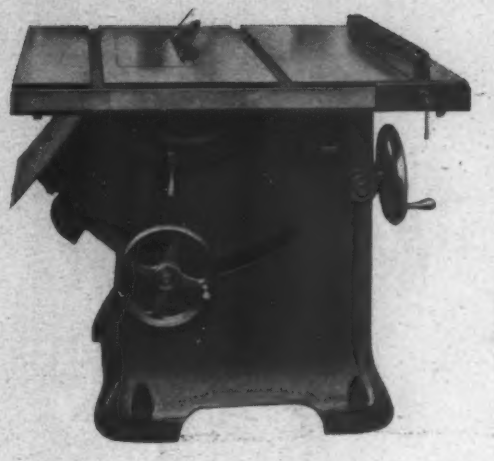
J-31 Hand Jointer—Particularly suitable for school shops. Modern in design — expertly engineered, a short study of its features will show that the J-31 is outstanding among 6 and 8 inch jointers. The Direct Motor Drive operates at 3600 R.P.M. and the Belted Motor Drive at 4250 R.P.M. The latter drive permits installation where unusual current characteristics are encountered. Cutterhead is round, 3-knife and mounted in ball bearings, is guarded front and rear. Infeed table is 2½" overwidth.

YATES-AMERICAN MACHINE COMPANY

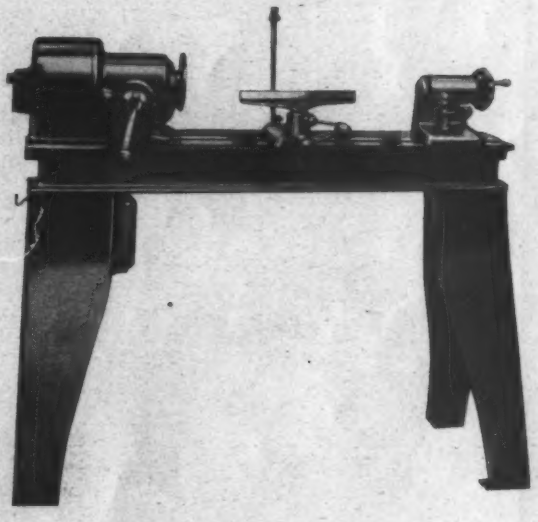
YATES-AMERICAN

POPULARITY IN SCHOOL SHOPS

G-89 Tilting Arbor Variety Saw. — Like all Yates-American saws the G-89 is designed for extreme accuracy on all straight or bevel cuts. It is built on a sturdy, one-piece frame with clean-cut sides, devoid of projecting parts. The rotor of the 3600 R.P.M. motor is mounted directly on the tilting arbor — there are no gears or belts to cause loss of power. Motor is totally enclosed, fan-cooled and dust-proof. The arbor and motor unit is mounted on accurately machined segment gibs for easy, precision tilting.



J-70 Speed Lathe — Equipped with extra large bearings which withstand heavy end-thrust, this lathe is perfectly suited to metal spinning when equipped with the proper motor and accessories. The variable speed provides an unbroken range of speeds from 800 to 2400 R.P.M. without stopping the machine or shifting a belt. The regular bed accommodates 24″ between centers, longer lengths are available. Swing is up to 12″ diameter. Both the head and tail stocks have No. 2 Morse tapers for centers.



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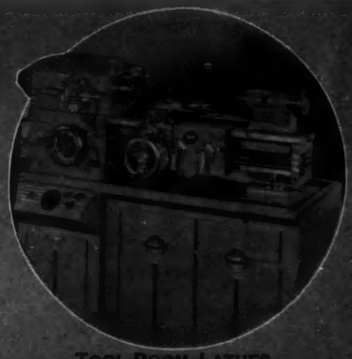
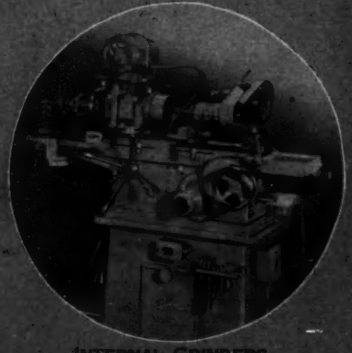


TOOL-ROOM LATHES

PLAIN BENCH LATHES

HAND SCREW MACHINES



INTERNAL GRINDERS

A JOB WELL TAUGHT IS LONG REMEMBERED

Many a fine toolmaker and master mechanic remembers the exacting problems given by his instructor and proudly recalls how he mastered the seemingly impossible tolerances with the aid of a Rivett lathe or grinder. Likewise many a scientist and engineer justly acknowledges the part played by a Rivett machine in his research and new developments. Today these very men rely on Rivett lathes and grinders when the closest precision limits must be maintained. In turn Rivett is proud of the part it has played in training master craftsmen and developing new products.

The first Rivett machine tools were made in 1884, and through the intervening years the builders have sought to perfect their every feature in pace with the progress of the times. Designing has been guided by wide and constant study of the usage in the field, and engineering has availed itself of new production methods and materials. Quality of workmanship has been protected by a group of skilled machinists and assemblers having life-long practice in the making and assembling of Rivett machines.

A proper and sound foundation of a machinist's training should include a knowledge of precision tolerances which can so well be taught on a Rivett machine.

Write for General Bulletin 500

RIVETT

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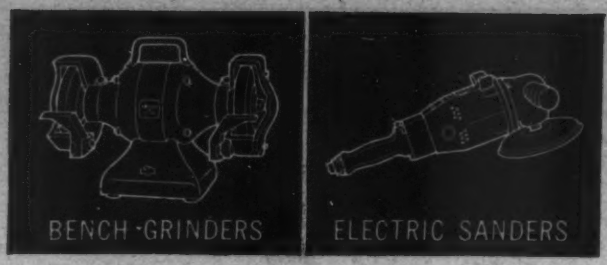

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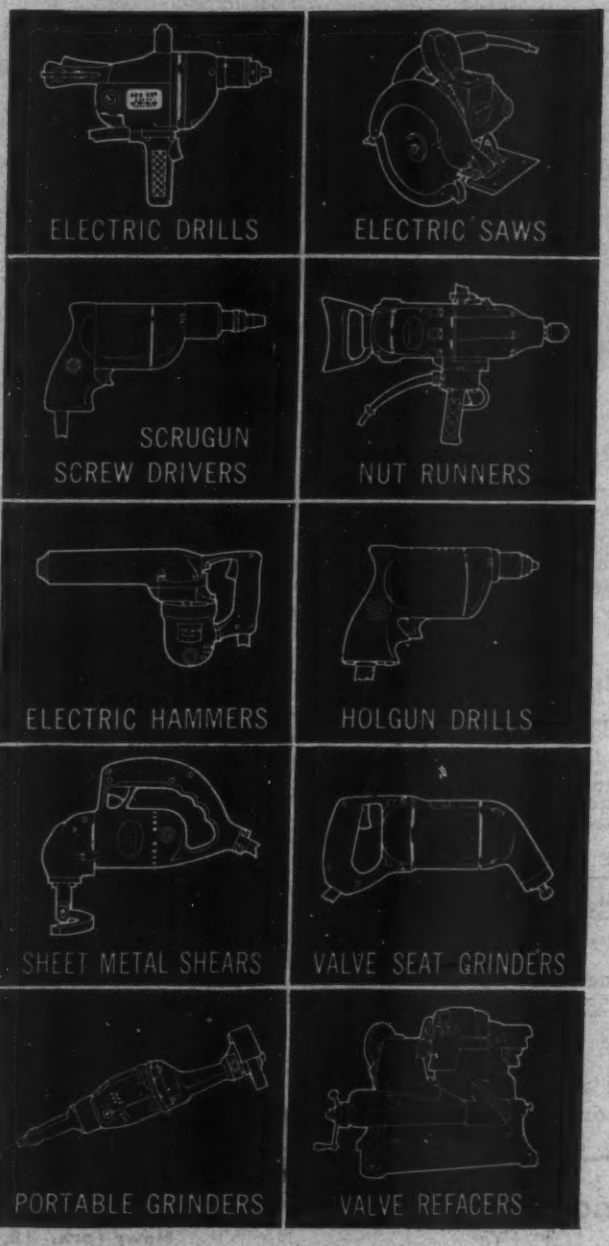

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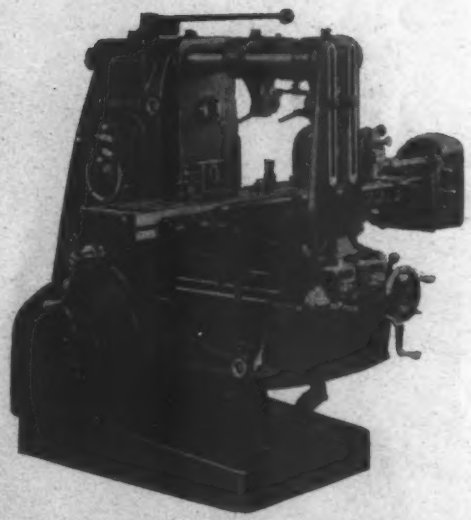
Milwaukee Machine Tools



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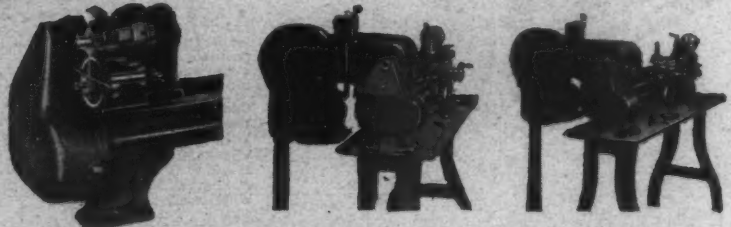

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Spindle speeds (direct belt driven) . . 179, 334, 420, 620, 780, and 1450 r.p.m.
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Vise No.	Width Jaws	Jaws Open	Weight Pounds
503	3	4½	28
503½	3½	5½	29
504	4	6	36
504½	4½	7	47
505	5	8	58
506	6	10	90

• COLUMBIAN MACHINISTS' VISES are designed to provide accurate and dependable equipment for school and industrial shops.

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604	4	6	42
604½	4½	7	55
605	5	8	70
606	6	10	106

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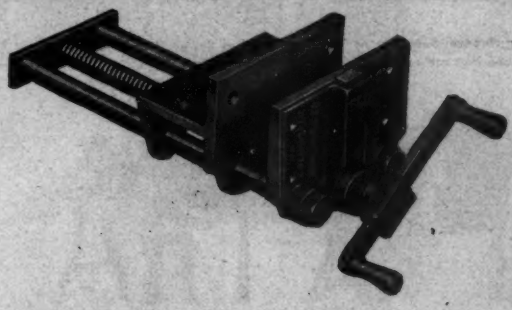
Jaws Open, in.	9	12	9	12
Weight, lbs.	24	32	25	33



• ADJUSTABLE STEEL HANDLE increases speed of operation. With the handle centered at the screw head, the shortened radius permits quick adjustment of opening. By extending the handle, extra leverage is obtained to tighten the vise.

Continuous Screw Steel Handle Vises	Plain Front Jaw		Dog in Front Jaw	
Vise No.	5C-S	3C-S	5CD-S	3CD-S
Jaw Size, in.	4x7	4x10	4x7	4x10
Jaws Open, in.	9	12	9	12
Weight, lbs.	24	32	25	33

Continuous Screw Woodworkers' Vises

• Extra heavy steel screw with carefully cut double threads operates in a solid malleable iron self-centering nut and insures positive fast action. Cold rolled steel guide rods, with drag bar as screw bearing, insure alignment and accuracy.

Continuous Screw Wood Handle Vises	Plain Front Jaw		Dog in Front Jaw	
Vise No.	5C	3C	5CD	3CD
Jaw Size, in.	4x7	4x10	4x7	4x10
Jaws Open, in.	9	12	9	12
Weight, lbs.	22	30	23	31

The Columbian Line also includes Combination Pipe Vises, Hinged Pipe Vises, Homeshop Vises, Blacksmiths' Leg Vises, Bench Anvils, and "C" Clamps.

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THE trend in teaching pottery making in vocational training courses is toward "GLOBAR"-equipped high temperature electric kilns.

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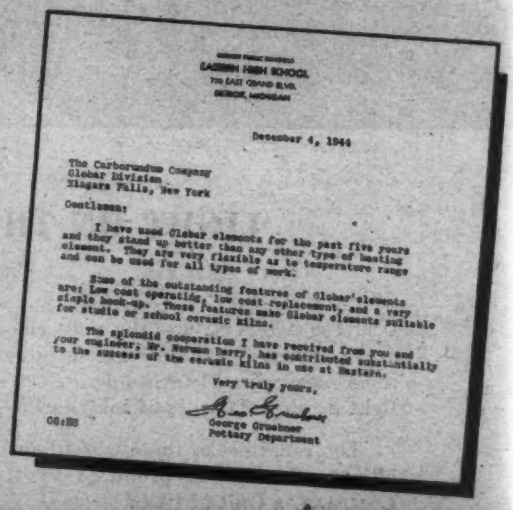

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Pottery Department

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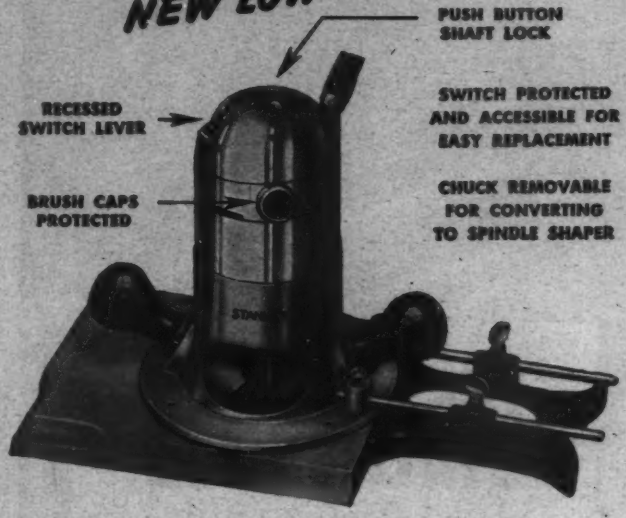
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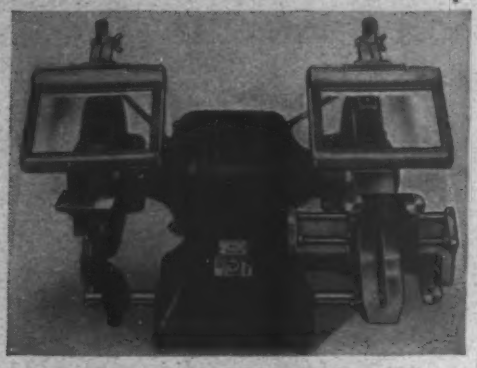

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GLASS SIZE 6" x 6"
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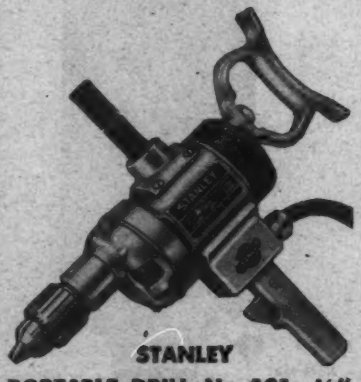

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Lathe File vs. Mill File. Because of the 45° angle of its teeth, the Nicholson Long Angle Lathe File overcomes filling up and consequently scratching the surface of the work—a tendency common in the shorter-angle Mill Bastard when used as a "lathe" file. The chips slide down the gullets and are forced out at the edge by the motion of the work against the file. This not only makes the file self-clearing, but provides much cleaner shearing, eliminates drag or tear, prevents "chatter," and assures much faster cutting.

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Note the long-angle teeth. Also, one edge of this file is "safe" (uncut) to protect shoulders of work and the "dog" of lathe.

The 1945 School Shop Annual

As in previous years, the School Shop Annual is packed with information pertaining to school-shop planning and equipping.

Because the war is still so prominently in the foreground, emphasis must continue to be on shop planning which portrays not only peace training, but also the training needed for war, war production, and the instructor training needed by our armed forces.

A survey of the adjacent table of contents will show that the 1945 School Shop Annual presents not only a wealth of pertinent information, but the list of authors gives the added assurance that the information is authoritative and dependable.

A Necessary Procedure

Your help in making the district zone number plan completely efficient in the handling of all types of mail is very necessary if you live in any of the larger cities covered by the post office zoning system.

Please check the wrapper on your magazine, and if it does not have the necessary zone number, such as Milwaukee *1*, Wis., clip the address, put on your zone number, paste the clipping on a penny post card, and forward it to us.

This is a very necessary procedure to facilitate handling all mail by the post office department. Your cooperation will be sincerely appreciated by them and by us.

Conventions

Check with the officers of the educational associations listed to ascertain whether a given convention is to be canceled.

- Eastern Arts Association
  Headquarters, Hotel Pennsylvania, New York City
  Date — April 5, 6, and 7, 1945
- Indiana Vocational Association
  Headquarters, Hotel Claypool, Indianapolis, Ind.
  Date — April 19, 20, and 21, 1945

This Month's Cover

The cover picture for this month shows the machine shop of the Mechanic Arts School, Evansville, Ind. It was submitted as an illustration to go with the article on page 90 of this issue, by W. A. Pease, Director, Vocational Education, Evansville, Ind.

BUY ANOTHER WAR BOND

Industrial Arts and Vocational Education

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE
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VOL. 34, NO. 3 MARCH, 1945

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Editorial Contributions. — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

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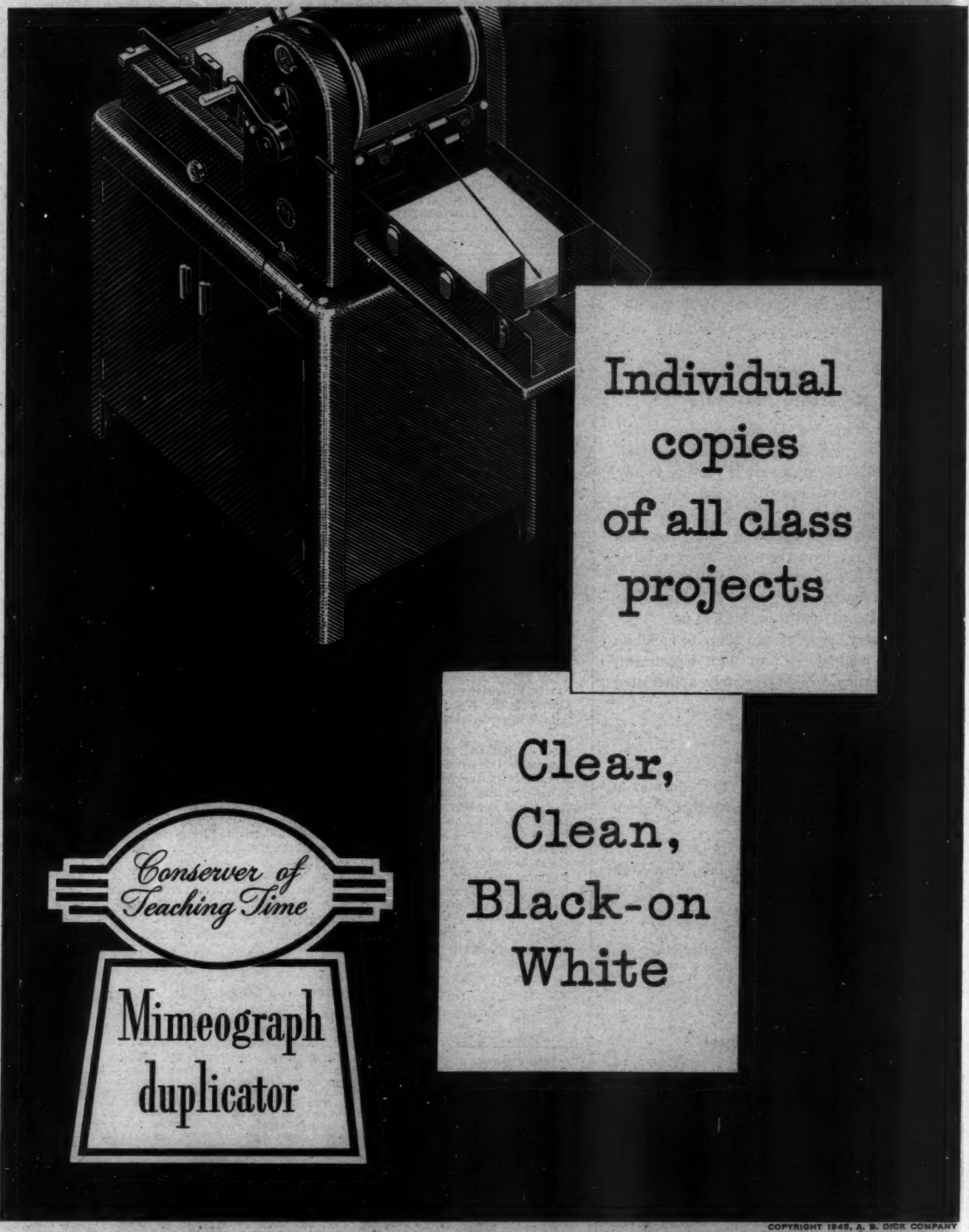

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A Vocational Building for War and Peace

Franklyn S. Barry[1]

Sidney is a small industrial community in the Southern Tier area of New York State. Its largest industry is the Scintilla Magneto Company, a subsidiary of the Bendix Aviation Corporation. The plant in Sidney manufactures magnetos and other ignition equipment for aircraft engines as well as similar equipment for specialized types of internal combustion engines. Because of the nature of its product, the Scintilla Company has been a great force in many phases of community life since the war began. This influence was also felt prior to the war when events throughout the world were pointing toward the present conflict. Expansion took place throughout the past decade at an increasing rate. Employment increased at a tremendous pace, and the need for skilled workers soon exhausted the supply in the entire area.

Obviously the local school was one of the first to feel this impact. Prior to 1938 the school offered four courses in industrial arts and four courses in mechanical drawing to train its graduates for work in the local industry. As the need for more of this type of training became apparent, registration in these classes increased to such an extent that it became necessary to provide additional space for the industrial-arts program. The department was moved from its small shop in the present high-school building to an abandoned high school near by where an entire floor was available.

At that time plans were also made with plant officials to set up a machine-shop course for high school graduates in the Sidney area, designed to train boys for the type of work done at the Scintilla Company. In 1939 a bond issue of $8000 was voted to start this program. Additional space in the abandoned high school was made available, and with some new machinery plus machinery donated by the local plant, the program opened in September, 1939. Twenty full-time boys were registered that year. Additional state aid and federal funds, with registration fees, made the program self-supporting from the beginning. One teacher was employed the first year to teach the group. Half of each day was spent in actual machine-shop practice and the remainder of the time was devoted to related work. Original plans called for a two-year course, as well as the employment of two teachers; one for the teaching of shop practice and one for the related work. The program was designed for two groups to make full utilization of the shop possible.

In August, 1940, the school was asked to set up a series of courses to train new employees for the Scintilla Company, and as a result the original program for a two-year, posthigh school machine-trades course was abandoned in favor of the new program. Two classes had been graduated and a follow-up study showed that a year's training had succeeded in making the boys valuable employees.

As the outbreak of the war drew closer,

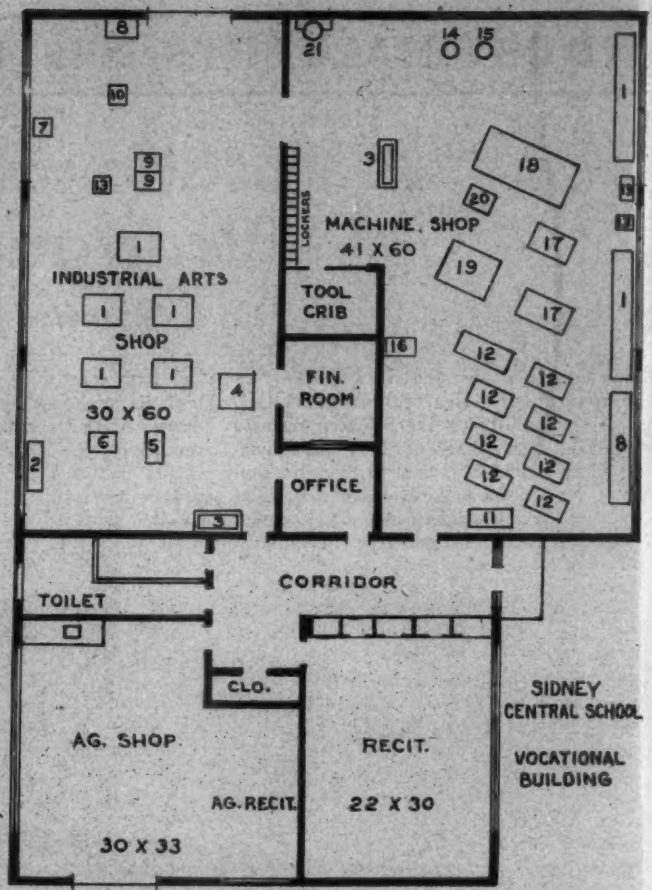
—Photographs by Charles Teed, Sidney, New York

Architect's Perspective, Vocational Building, Sidney Central School, Sidney, New York. — Myron A. Jordan, Architect, Richfield Springs, New York

[1]Supervising Principal, Sidney Central School, Sidney, N. Y.

The recitation room serves both for general academic work and mechanical drawing

The milk testing bench in the agriculture shop is used daily for determining the quality of the milk produced on the students' home farms



Key:
1 Bench
2 Wood Lathe
3 Sink
4 Circular Saw
5 Jig Saw
6 Band Saw
7 Grinder
8 Bench Lathe
9 Drawing Tables
10 Hack Saw
11 Desk
12 Lathe
13 Drill Press
14 Surface Grinder
15 Tool and Cutter Grinder
16 Power Hack Saw
17 Shaper
18 Universal Grinder
19 Milling Machine
20 Miller
21 Electric Welder

hundreds of new families moved into Sidney and the surrounding area, and the school population increased accordingly. After a thorough study of available facilities it was decided to remodel the building housing the vocational program for use as an elementary school. At the same time plans were formulated for another building to house the machine-trades course, the industrial-arts program, and vocational agriculture.

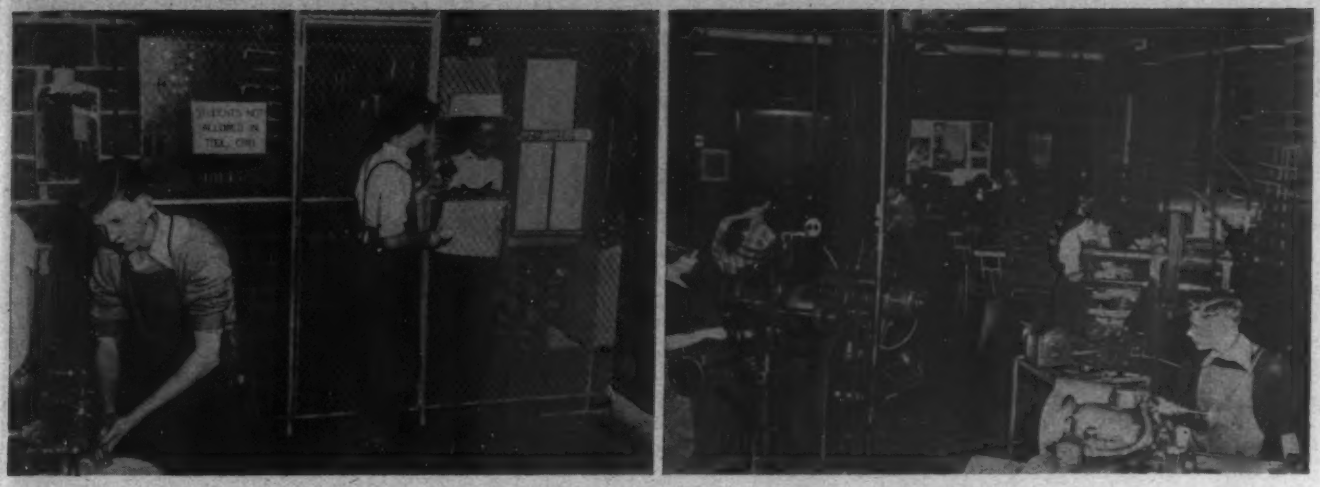
The Sidney School District at the time was carrying a bonded debt on the present high school building of nearly $300,000. This, plus other issues on a new elementary building, a playground development, and an issue for new buses brought the total bonded debt to approximately 10 per cent of the assessed valuation of the district; a figure above which a school district in New York State is not allowed to go without special permission from the New York State Board of Regents and a two-thirds vote by those voting on the bond issue.

In view of this and in view of the impact of the war on the community, the Federal Government was asked for assistance under provisions of the Lanham Act. Application was made for funds and a grant was made to the school district for the construction of a new building to house the vocational program and also for the remodeling of the abandoned high school into an eight-room elementary building. This grant totaled slightly more than $67,000. In the planning that followed, $35,500 was allocated for the vocational program and the remaining $31,500 allocated to the remodeling. At first, it was thought impossible to construct a new building of the desired size in wartime for the money available, but when the four contracts were totaled, the final figure was $35,818! A great deal of planning and economy had made this figure possible and a large amount of credit goes to the architect, Mr. Jordan, and to Mr. Fales and Mr. Lang of the New York State Education Department for the time devoted to the final development of the plans.

The building itself has an over-all length of 103 ft., and a width of 74 ft. and 58 ft. The outside height is 15 ft. 5 in., and the ceiling height 11 ft. 9 in. All walls and partitions with the exception of those in the toilet are of cinder block. Commercial steel sash and precast concrete window sills are used in the building throughout. The roof is of the deadlevel, built-up type, laid over ⅞-in. sheathing and 1-in. insulation. This is carried by 2 by 12-in. wood rafters on steel beams. Steel columns located in the outside walls and partitions carry the entire roof load. Roof rafters are double bridged and left exposed. Heat loss with this type of construction seems to be relatively low.

The foundation walls are of poured concrete, 12 in. thick, 5 ft., below grade. The floor has a 2-in. cement finish laid over a 4-in. reinforced concrete slab over a 6-in. tamped gravel fill. It has been necessary on several occasions to use a concrete floor seal and paint throughout the building as the concrete has a tendency to "dust."

The building secures its heat, electricity, and water from the main high school building. Overhead unit heaters with fans heat both of the larger shops, and unit heaters and cast-iron radiation are used to heat the classroom and the agriculture shop. All of these are regulated by automatic temperature controls. All interior piping is carried in pipe trenches below grade. A circulating pump attached to



Left: The tool crib. Right: General view of the machine shop

the hot-water line in the main building gives instant hot water throughout the building.

Clocks in all of the rooms, as well as the fire alarm system, are attached to and controlled by similar systems in the main building. Factory-type, R-L-M fixtures, 18 in number, light each of the larger shops with similar fixtures in the tool crib, office, finishing room, agriculture shop, and the machine shop. Fluorescent lamps lighting the display cabinet are controlled from the office. All circuits in both the industrial-arts shop and the machine shop are operated from a single panel under the control of the instructor.

Power for machines in the machine shop is obtained from a suspended 3-phase, 220-volt, 375-ampere bus duct. Wall outlets are located in all three shop rooms above bench level at 5-ft. intervals.

The classroom is of standard size, with blackboard on two sides. Bulletin boards cover a large part of the back wall. A blackout curtain makes the room available for motion pictures and other visual aids widely used in this type of education. The woodwork in this room and all other rooms is oak, finished in natural color. Acoustics throughout the building are excellent due to the exposed ceilings and cinder block walls.

The agriculture shop has a small alcove for classwork, and a masonry milk testing bench. A large overhead door allows farm machinery to be brought into the room.

The industrial-arts shop also has an overhead door. Windows and glass doors into the adjoining finishing room and office make supervision possible. Gas outlets in all three shops allow for heat-treating furnaces, and other gas-fired apparatus. The industrial-arts room has an area of slightly more than 1800 square feet and is arranged at present to teach six units of work on a comprehensive shop basis. A gang sink is located near the main entrance. Lumber is stored vertically, and blackboard and bulletin board space has been provided.

The machine shop has a total floor area of slightly more than 2200 square feet and has machines and bench space for approximately 25 workers. A masonry welding booth with an asbestos shield is located in one corner, and fumes are exhausted by a motor-driven fan. This fan also is used to exhaust the dry grinders located near it. A tool crib, separated from the shop by wire screen, is used to store the small tools and equipment. Lockers and a gang sink are located near the front of the tool crib. Each machine is individually lighted. All equipment has been purchased new since 1939 with the exception of one universal-type milling machine. The total investment in machines and small tools is well over $35,000.

The industrial arts shop is organized on the general shop basis and provides work ranging from simple woodwork through metalwork and aeronautics

The factory-type construction of the building inside and out lends a shop atmosphere not often found in school shops, and in general has been found very satisfactory. After three years of occupation, however, certain changes would be made if the building were to be reconstructed. As mentioned before, the dust from the cement floors in the machine shop which has been a hazard to the precision equipment in this room, has been corrected by use of a cement sealer. The agriculture department is inadequate in size, but its design has worked out satisfactorily. The building should also have an additional classroom. Since aviation has become an important part of the industrial-arts program, a larger shop could be used in this department. The machine shop, both in design and size, has proved very satisfactory. Two toilets would be included in plans for a new building as the need for training both sexes for industry would indicate.

Since August of 1940, over 4000 men and women have received training in the War Industries Training Program operated by the school. Vocational education in Sidney is now a part of the entire community. It has created for the school excellent working relations with industry. It has shown that the school can do a specific job of training. Postwar plans are under way to renew the training of high school graduates for the machine trades and to make this an Area-Vocational School to serve the needs in a large radius about Sidney.

The Mechanic Arts School at Evansville

*W. A. Pease**

The Mechanic Arts School is a part of the free public school system of Evansville, Ind., and as such is operated by the board of education. Being a vocational school, it receives a certain amount of state and federal financial support in accordance with the Smith-Hughes and George-Deen Acts.

The building houses a broad educational program designed to meet the needs of Evansville as a growing industrial community. In general, this educational program falls into two parts, the day trade preparatory school for boys of high school age, and the trade extension or adult program which includes apprentice training.

Vocational Education in Evansville

Vocational training in Evansville had its origin in 1903 when courses in cabinet-making and mechanical drawing were introduced at the old Evansville High school which is now Central High School. Nine years later the curriculum was expanded to include machine-shop practice and foundry practice.

Gradually other new courses were added and the program was extended to other schools so that at the time Mechanic Arts School became a reality, each of the 16 elementary schools had shops well equipped for offering generalized industrial-arts programs and each of the public high schools had provision for offering training in printing, mechanical drawing, woodworking, and auto repair. In addition, Central High School had a reasonably well-equipped machine shop and a trade extension program that had been in progress there since prior to 1917. A rotating shop technique was, and still is in use in the comprehensive high schools, and freshmen boys who have enrolled in the industrial-arts curriculum have an opportunity through these finding courses to make a better and wiser vocational choice than would otherwise be possible.

Even though the industrial training program in Evansville was well advanced, community leaders early saw that training facilities, particularly in the higher skilled brackets, were inadequate. Early in 1936, the Evansville Foremen's Club recommended to the board of education that the vocational education program be expanded to meet local needs and, at the same time, pointed out the shortage of skilled labor in Evansville.

Also in 1936 the faculty of Teachers College, Columbia University, was employed to direct and carry out a survey of the public school system in Evansville. Certain comments and recommendations made in the report of the survey staff corroborated the recommendations of local leaders. The report said in part "A local survey of vocational opportunities should be made to serve as a basis and a guide for the selection of types of courses and their content, as well as for the number of workers who may reasonably be expected to become absorbed into the local industries." The survey report further said "Vocational-industrial courses should be confined within a centrally located trade school, with enrollment open only to pupils at the 11th and 12th grade levels or to those who will soon be eligible by age for entrance into industry."

Because of the apparently growing need and because of the keen interest on the part of local leaders, a vocational education advisory committee was appointed for studying the problem. This committee composed of industrialists and representatives of the Foremen's Club and of organized labor, immediately set to work under the chairmanship of the superintendent and in April, 1937, a trade and industrial co-ordinator was appointed upon the recommendation of the advisory committee. The co-ordinator was appointed for the purpose of assisting the director of adult and vocational education in planning and developing a broad vocational program which, by this time, seemed almost sure to become a reality. Work began, and in accordance with the recommendations of the Columbia University Survey Staff, an industrial survey was conducted and the specific needs of the community were determined.

The Vocational Education Advisory Committee, representing industry, labor, and the public schools, continued to study the problem and in a report to the board of education said that the committee members "unanimously believe that some system of specific trade training in a modern building is of vital importance at this time." And, so on June 25, 1937, the first steps toward the construction of a new school were taken by the board of education when the architectural firm of Fowler and Legeman was employed to prepare preliminary plans.

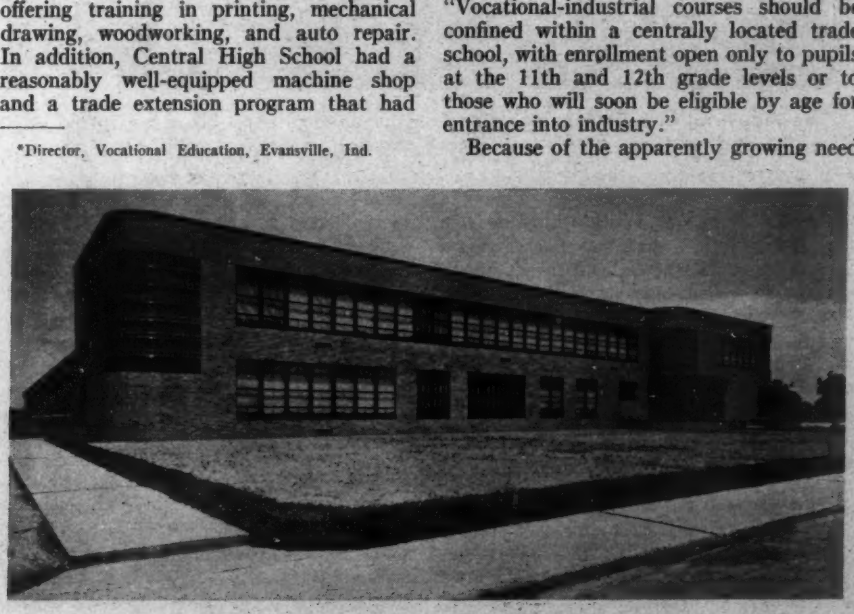
Approximately, one month later, a 22-acre tract of land located on north Stringtown Road between Wedeking and Diamond Avenues was purchased by the board.

In January, 1938, the board of education approved preliminary plans prepared by the architects and sold a $250,000 bond issue to be used in the construction of the building and in part for the purchase of the ground.

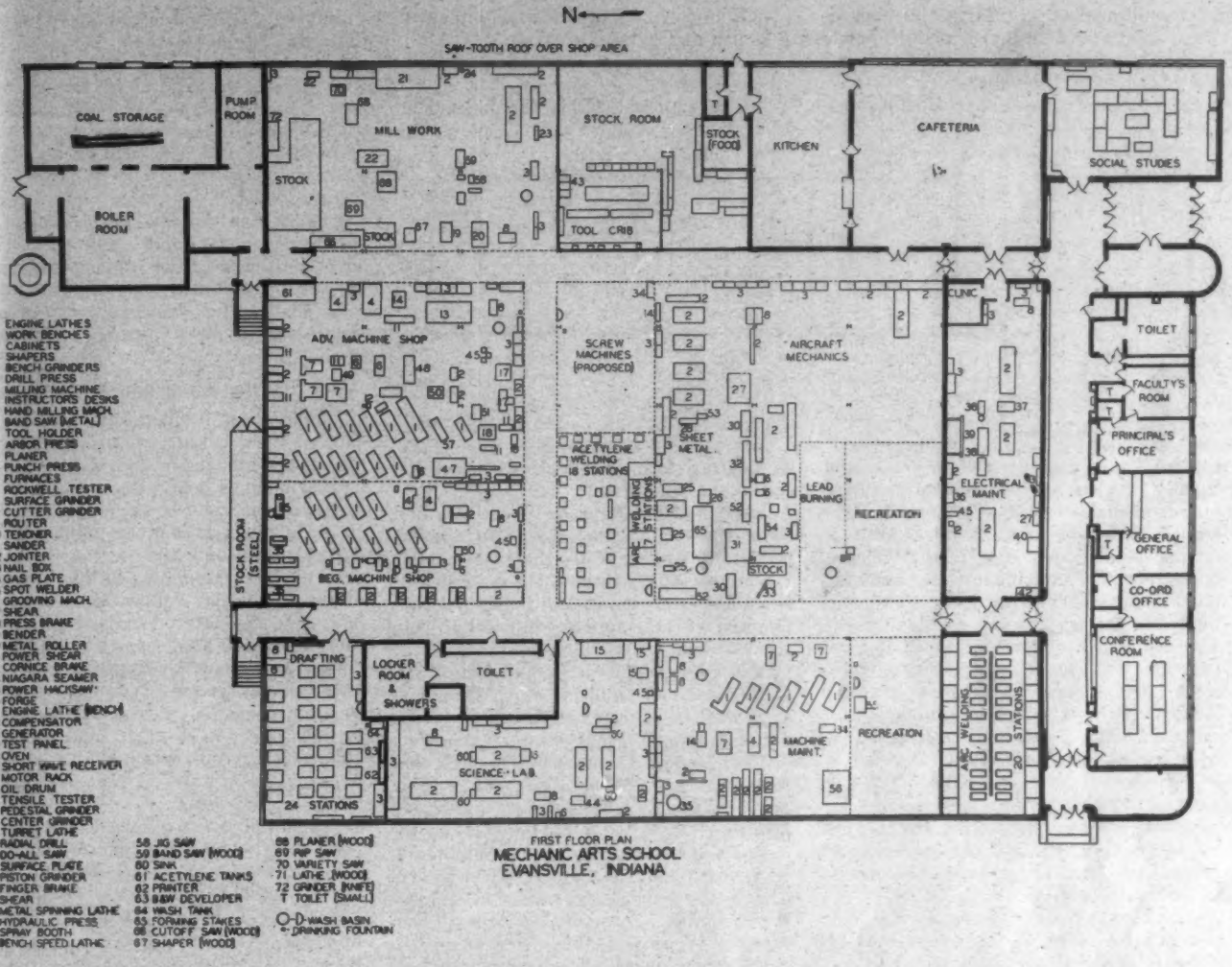
In the summer of 1938, ground was broken on the new site and in January, 1939, Mechanic Arts School was a reality and opened the doors of its $200,000 building for the first time to 150 day school students who were transferred from Bosse, Central, and Reitz High Schools.

Just as expert planning laid the groundwork for a modern building, likewise extreme care was exercised in equipping the shop area of the school plant. Numerous craft advisory committees were employed in determining the amount and nature of the equipment to be purchased for the several shops. While some equipment was moved from the old Central High School shops, the purchase of additional equipment totaling $80,000 in value made necessary the utilization of an equipment purchasing committee composed of individuals from the field of industry whose vocational pursuits included the purchasing of shop equipment. And so, when the

*Director, Vocational Education, Evansville, Ind.



Mechanic Arts School, Evansville, Ind.



FIRST FLOOR PLAN
MECHANIC ARTS SCHOOL
EVANSVILLE, INDIANA

school opened at the beginning of the second semester in January, 1939, 11 instructors, several of whom came directly from the field of industry, and 150 students set about the huge task of organizing a new school in such a fashion as to obtain the maximum value from the opportunities that had been afforded by the board of education. Shop teachers found themselves in virtually a bare shop with no equipment set in place and with part of the equipment not yet on the floor. Through tireless activity and through universal cooperation, students and teachers together emerged from that first hectic semester with the feeling of accomplishment and with the shops completely outfitted and in operating order.

The Day Trade Preparatory School

The day trade preparatory school is operated by the board of education and receives a part of its financial support from state and federal funds under the Smith-Hughes and George-Deen Acts. The school is for boys who have not yet graduated from high school, and who wish to receive trade preparatory training with the expectation of entering one of the basic skilled trades in local industry.

Besides the dean and the co-ordinator, Mechanic Arts School has 11 full-time instructors, all of whom have been chosen because of their qualifications in terms of the specific requirements of their instructional tasks.

A boy in entering Mechanic Arts School is assigned to one of the six following shop areas, and is expected to pursue his studies therein during his stay at the school. These courses are:

Aircraft Engine and Airplane Maintenance: Both courses lead to CAA examination for licensing.

Machine Shop: The school has two machine shops, the beginning shop and the advanced shop. Boys who desire to become skilled machinists or who eventually hope to become tool and diemakers enter the beginning shop where they learn basic bench operations and elementary lathe procedure along with other beginning shop techniques. He spends two semesters in the beginning shop, and then is transferred to the advanced shop where he gets more advanced training, including screw machine operations, tool cutting and grinding, milling machine operations, etc. The advanced shop is exceptionally well equipped and a high level of training is possible in this particular area.

Machine Drafting: The Mechanic Arts School drafting room is equipped with 24 modern drafting tables and complete blueprint making facilities. Boys receive training in various areas of drafting and design and attain a high degree of competence by the time they graduate.

Sheet-Metal Shop: The sheet-metal shop is quite adequately equipped with such power devices as power shears, spot welder, press brake, and roller. The training in the shop is geared to the demands and needs of the local community and training includes pattern work as well as assembly work.

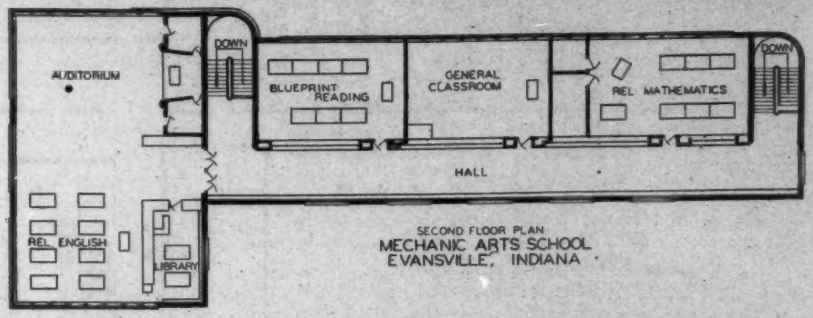
Machine Maintenance: While emphasis in this shop is primarily upon machine maintenance or the repair and upkeep of machinery, training is also given in virtually all areas of maintenance. Students receive instruction in wood and metal repair work, some plumbing and pipe work, spray and hand painting, and a small amount of welding.

Mill Work: The mill room is exceptionally well equipped for giving training in mill work, cabinetmaking, and some patternmaking. A great deal of emphasis is also placed upon the upkeep and maintenance of power driven mill room equipment.

Electrical Maintenance: The electrical maintenance course is primarily designed to fit boys for Evansville industry. However, training is given in phases of electri-

cal installation as well as in the maintenance area. Students install conduit, repair electrical appliances and fixtures, and rewind and rebuild motors.

Each student spends approximately one half of his school day in the shop of his choice. The remaining half day is about equally divided between related technical instruction and nontechnical work. The related technical area includes work in related mathematics and related science, both of which are taught as subjects applied to the student's particular shop area; related blueprint reading is also taught. The one fourth of the day which is given over to nontechnical instruction includes work in practical English and social studies, both of which are taught in a unique fashion planned to meet the needs of Mechanic Arts boys.



SECOND FLOOR PLAN
MECHANIC ARTS SCHOOL
EVANSVILLE, INDIANA

Because of the extreme importance of safety in the industrial picture today, considerable emphasis is placed on that area in Mechanic Arts School. Students are given both formal and incidental training in industrial safety.

Unlike many trade preparatory schools, Mechanic Arts School has retained a large number of desirable features of the comprehensive high school. The extracurricular program at the school includes student clubs which meet weekly, an intra-mural athletic program, noon recreational programs, weekly assembly programs, and some out-of-school social functions. School spirit is an important thing at Mechanic Arts, and the boys have developed a pride in the school and all that it stands for.

While Mechanic Arts School, at the present time does not grant a high school diploma, nevertheless, when a student has finished his trade preparatory training at the school he simultaneously receives his regular high school diploma from the comprehensive high school from which he came.

Admission to Mechanic Arts is only by transfer from one of Evansville's four high schools. Students moving to the city must first transfer their credits to one of the public high schools.

Only students who are either 10A's or 11B's at the time of application will be considered. In order to apply for admission, a student must have:

1. Four credits in English.
2. Two credits in social studies.
3. Two credits in mathematics.
4. Completed graduation requirements in health and gym.
5. A minimum of 16 credits in solid subjects.
6. The approval of his parents and an understanding that he will not request to be returned to his home school before the end of the semester.

After students have become 12A's and have reached the age of 18, they are expected to register with the co-ordinator. During the 12A semester, the co-ordinator holds numerous group and individual conferences with the students in order to help them to understand the importance of the proper approach in the job interview and similar personal problems which are apt to arise when a young man is seeking or has obtained employment.

The statement is frequently made that Mechanic Arts School does not "place" any student. In no sense does the school guarantee a boy a job. However, as the co-ordinator goes about in the community, he is continually in contact with personnel directors, foremen, and others in employing capacities. Through this intimate contact, he is continually determining the employment needs of the community and can be a tremendous help to the student who is leaving the school.

Even after a student leaves the day school, the school is still interested in him. An important phase of the co-ordinator's work is his follow-up activity wherein he continually watches the progress of boys who have graduated from the school. This work is extremely important for two reasons. First, by watching the boy and keeping in contact with him, the co-ordinator is able to encourage him to continue his training in the adult or apprenticeship programs at Mechanic Arts School. Second, through close observation of those who have gone out from the school, it is possible for the co-ordinator to know the strengths and weaknesses of the training that has been given in the past, and, consequently, to report back to the dean and the instructors in the school, in order that instruction in the future may be more effective.

The school has a complete modern cafeteria which is operated under the supervision of the director of cafeterias of the public schools. Excellent, well-prepared food is served each noon at reasonable prices. However, students may bring their own lunches if they prefer, and arrangements have been made whereby they use the tables and other facilities of the cafeteria.

Surveys conducted in the school indicate that the cost of attending Mechanic Arts School in general is neither higher nor lower than is the cost at the comprehensive high schools. The cost of books and personal supplies compares very favorably with that of the high schools and every effort is made to prevent the cost from being excessive.

Emphasis in the day school is upon the social, vocational, and emotional growth and adjustment of the student. All phases of this instructional program are highly individualized but sufficient group activity is included to allow adequate socialization of the student.

The Adult Education Program

Unlike many Indiana cities which discarded their adult education programs during the first depression, Evansville has had a night school program which has operated continuously since prior to 1917. In addition, it is well to point out that during the second semester of the school year 1939–40 the adult education program of the Evansville Public Schools was the largest in the state of Indiana with something like 2400 adults participating in the various phases of the program.

In all phases of the adult education program competent instructors are chosen by the director of adult and vocational education in conjunction with the group or groups concerned in the training program. In all instances these instructors are men who are recognized as experts in their crafts, and every effort is made to select men who are competent and qualified to handle the instruction of the group.

Because of the broad scope of the adult program, it is broken down here into four general categories, each of which follow: regular evening trade extension classes; foremen conferences; apprenticeship classes; specialized programs.

Standard evening school courses are 36 hours in length and meet one night per week for 12 weeks. Specialized courses of longer or shorter duration may be offered when a need arises.

The regular evening trade extension courses are made possible through financial support from state and federal funds, and, consequently, their administration is subject to certain regulations. In general, regular evening trade extension classes are open to persons who are

1. Over 16 years of age,
2. Not enrolled in school,
3. Who are or have been employed in an occupation related to the course offered, and
4. Who can profit by the instruction.

The basic enrollment fee for each course is $1.50. In certain instances, additional charges are made for courses using specialized equipment or materials.

The director of adult and vocational education reserves the right to discontinue the meeting of any class provided there is not a minimum of 15 students enrolled.

Certificates will be issued to all enrollees who successfully complete any course provided they have been in attendance at least 80 per cent of the time.

Many students come to the evening school with an indefinite idea of the course best suited for their needs. Other students come, having finished certain courses, need advice with regard to enrolling in other courses in order to obtain a well-rounded training. All students are free to counsel the director of adult and vocational education or the trade and industrial coordinator whenever they wish.

The specific list of trade extension courses offered varies from semester to semester, and lists of offerings are made available from the Vocational office twice each year. However, the following regular trade extension classes met during the second semester of the school year 1939–40.

1. Print Reading I and II
2. Diesel Engines
3. Elec. Maint. I and II
4. Machine Shop I and II
5. Machinery Handbook
6. Measuring Instruments
7. Mech. Drawing I and II
8. Metal Finishing, Rust Proofing, and Electroplating
9. Refrigeration Service
10. Sheet Metal Layout
11. Shop Math. I and II
12. Slide Rule
13. Welding

Competent conference leaders are selected by the director of adult and vocational education in conjunction with the group or groups concerned.

Another specialized phase of the trade extension program is the apprenticeship training program.

Between the time the building was opened in January, 1939, and December 15, 1944, the trade extension, N.Y.A., National Defense and War Production Training programs, 27,962 persons received training for a total of 2,240,683 training hours.

A total of 643 students have graduated from the two-year course at Mechanic Arts School up to and including the first semester of the year 1944–45.

Advantages of Factory Type Construction

All electric wire, air, gas, and water lines are overhead. Changes in layout are easily and quickly made because of this feature. Three woodworking machines are the only exceptions. With the pipes overhead, expansion and contraction of training areas was simplified. This was a great advantage during the peak of war production training when it was necessary to set up 160 aircraft work stations. Students are easily adjusted to industrial plants because of factory type construction of the school. The only change which would be helpful would be the erection of a small glass enclosed class room in the area taken up by the screw machines. The seven sawtooth sections with glass areas on the north side furnish excellent light to the entire shop area.

Mooseheart's New Industrial-Arts Woodworking Shop

*J. A. Brandt**

At Mooseheart it has long been accepted that a well-organized woodworking course for junior high students is highly desirable for a number of reasons, the most important being that in this shop students are introduced to and familiarized with shop organization and procedure.

*In charge of shop installation and course development, Mooseheart, Ill.

It has also been determined that the effectiveness of a woodworking course depends to a great extent upon how thoroughly the shop is equipped with tools, machines, and the like. Several years ago funds became available for thoroughly streamlining our woodworking shop. It was to have all new equipment and new quarters.

Installation was postponed pending a survey to determine up-to-date practices and equipment improvements.

While funds were available for all necessary equipment, the aim has been not to overequip, but rather to plan a shop that would be complete in every respect, provide for efficient organization and serve as a model that could be duplicated in any school.

This article will not cover in detail all the features of equipment and organization but will only present an over-all picture of the entire shop. Details will be covered in future articles with the hope that such information may prove of value to any teacher or school executive contemplating the installation of this type of shop.

The basic objectives of Mooseheart's woodworking course are as follows:

1. To develop an understanding of shop organization and procedure.
2. To develop the ability to undertake the intensive prevocational training that is offered through the regular vocational shops.
3. To establish an intelligent attitude relative to the woodworking field as a vocational opportunity.
4. To develop an understanding and skill in using the common woodworking tools, machines, and materials.

Supplementing the foregoing objectives, such knowledge and skills will prove useful to the student in the maintenance of his

General view of Mooseheart's new industrial-arts woodworking shop

Fig. 1. Four-station bench showing toolbox and student's work compartments.

Fig. 2. Student's toolbox for individual tools

Fig. 3. Toolbox cabinet in toolroom

future home, and provide a foundation upon which to build an interesting hobby or a profitable avocation.

The floor space of the new shop is 22 ft. 6 in. wide by 83 ft. long. At one end a space 9 ft. by 22 ft. 6 in. is divided into two floors. This space is used as an instructor's office, toolroom, and storage space for lumber and other supplies. One side of the shop consists entirely of windows.

The floor which was of rough concrete presented difficulties in sweeping and a constant source of trouble in that it dulled or broke tools dropped on it. To overcome this difficulty a mastic floor covering 3/16 in. thick was troweled on over the concrete. To completely eliminate dust three coats of floor or gym seal were applied to the mastic. The result is a floor that is easy to clean, attractive in appearance, and one that materially reduces tool damage.

Equipment is provided for a class of 16 students but since floor space was limited, and since there was no standard bench available that would fully meet our requirements, the 4-station bench embodying a number of special features was designed. These benches have a 6 by 6-ft. working surface and were constructed by Sheldon and Company. In actual use these benches have proved exceptionally satisfactory in every respect.

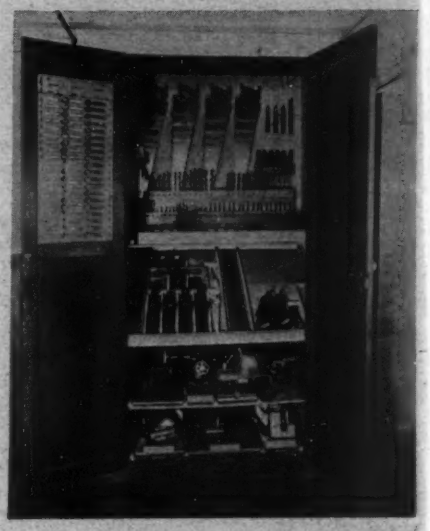


Fig. 4. Tool crib for general tools. Check board is shown at the left

Individual tool equipment is complete and of the best quality. Because it is desirable to limit the use of individual tools to one boy per each section, and to pro-

Fig. 5. Staining and finishing cabinet with working surface in open position.

Fig. 6. Staining and finishing cabinet showing lower compartments

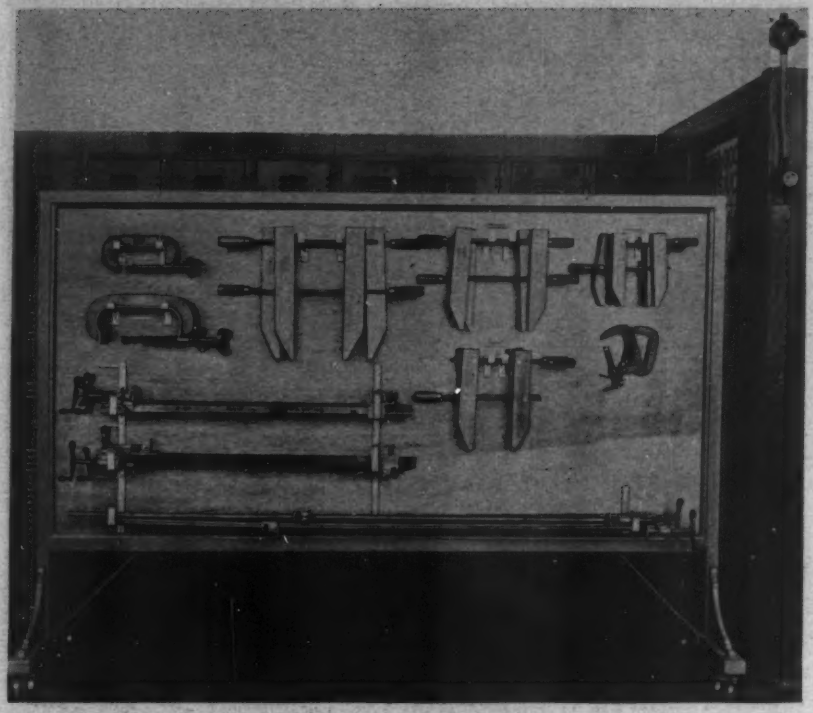


Fig. 7. Movable hand screw and clamp rack

shown in Figures 5 and 6 was constructed and installed. It is completely lined with galvanized steel. It provides space for materials in use, and the storage of reserve materials in the lower compartments which may also be used for the storage of students' work being finished. The most important feature of this cabinet is that it provides a convenient, easy-to-clean working surface where finishing work can be done, and prevents the defacement of workbenches. This patented cabinet incorporating many new features will be available after the war. It will be constructed of steel.

Due to the small amount of wall space available, a ¾ in. by 4 ft. by 8 ft. plywood panel was set in a frame mounted on casters. On both sides of this panel, racks are provided for all hand screws, bar and C clamps and the entire panel can be quickly moved to any part of the shop where clamps are being used. See Figure 7.

In this shop all gluing is done on the metal covered bench shown near the staining and finishing cabinet in Figures 5 and 6.

Mounted on the wall, convenient to the various power machines, are cabinets with racks provided for holding saws, dado

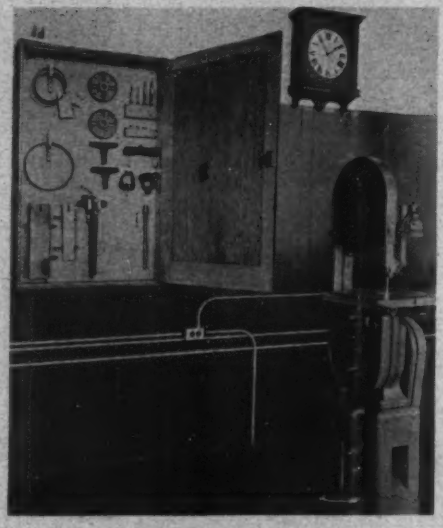


Fig. 8. Machine-parts cabinet

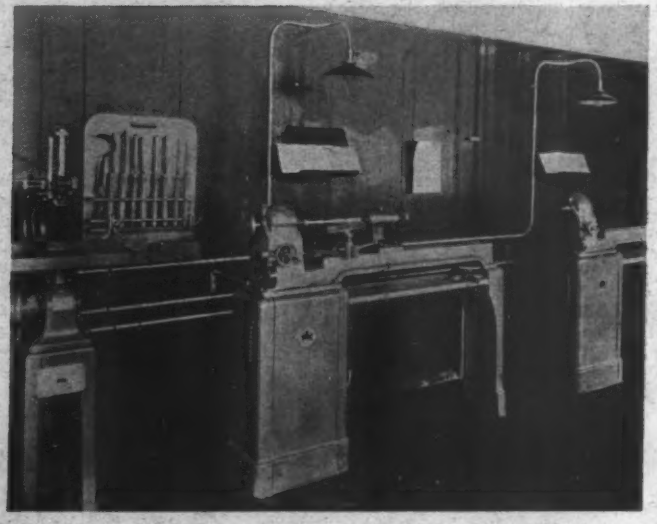


Fig. 9. Lathe tool and instruction sheet holders

vide an efficient method for the care and constant checking of these tools, and because conventional methods were found inadequate, a specially designed toolbox was developed for this purpose. The box provides a space or compartment for every individual tool. As shown in Figure 2, the toolbox was left open at the bottom to insure cleanliness. The use of this toolbox entailed the development of a storage cabinet in the toolroom and a compartment in the bench. The tool compartment in the bench is shown in Figure 1.

The toolroom cabinet for the storage of toolboxes is shown in Figure 3. This cabinet makes possible the quick delivery of toolboxes at the beginning of class periods and for their thorough checking and return to the cabinet at the end of each shop period.

Twenty toolboxes were built and fully equipped with tools. The extra boxes are stored in the end section of the cabinet and their removal prevented by the panel shown in Figure 3. All tools are permanently marked by having numbers stamped or etched into convenient surfaces.

Each student is assigned a shop number and general tools and machines are checked out of the toolroom by the use of checks. To eliminate the constant replacement of these checks due to loss, they are not issued to the students but kept on the checkboard shown in Figure 4.

The accumulation of stains, oils, paints, and other inflammable materials that normally become a part of a shop detract from its appearance. They also constitute a fire hazard. To overcome these conditions the staining and finishing cabinet

head, and all supplementary equipment and adapters for the various machines, as shown in Figure 8.

The power machine equipment includes two Walker Turner Variable Speed Wood Lathes. On the wall back of these lathes are mounted instruction sheet holders and to the left of each lathe is a removable tool rack holding a complete set of wood-turning tools, oil stone, gauge slip, dividers, pencil, and rule. See Figure 9. When not in use this lightweight rack is checked in at the toolroom. The bottom of the rack is made of dowel rod. The rack was developed from a drawing and description by W. E. Warner which appeared on page

351 of the October, 1943, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

Another device necessary because of the lack of wall space is a small blackboard mounted in a frame and hung with sash weights so that it can be pulled down for use or pushed up out of the way when not in use. This is necessary so that it does not block the view from the toolroom or office at any time. In the foreground in Figure 10 is shown the instruction-demonstration bench. On the demonstration bench is also shown a cabinet and rack for displaying and caring for a set of Stanley tool charts.

Individual Tool Sets

1 Panel saw	1 8-in. dividers
1 Rip saw	1 Sloyd knife
1 Mallet	1 Butt gauge
1 Claw hammer	1 6-in. try square
1 Oil stone	1 Pencil
1 9-in. smooth plane	1 Each ⅛-, ¼-, ⅜-, ½-, ¾-, and 1-in. socket butt, bevel edge, wood chisel
1 Block plane	
1 6-in. carpenter's pincers	
1 12-in. backsaw	1 2-ft. rule

General Tools

2		28-in. rip saws	1	pr.	button pliers
2		28-in. panel saws	2		Putty knives
4		Bevels	3		2-in. socket type chisels
6		Handy clamps	3		1½-in. socket type chisels
1	set	auger bits ¼ in. to 1 in.	3		¾-in. by 8-in. socket type chisels
1	set	machine auger bits ¼ to 1 in.	1	pr.	3-in. tinner's snips
18		Assorted size nail sets	1		Adjustable hack saw
2		Rose countersinks (bit stock)	1		Small wrecking bar
2		Machine countersinks	1		Large wrecking bar
5		Router bits ¼ to ½ in.	6		Chip carving knives
2		Plug cutters ½ and ⅝ in.	4		Glass cutters
1	set	jobber's drills	1		22-in. jointer plane
1	set	numbered drills	4		14-in. jack planes
3		Bit gauges	1		Emery wheel dresser
8		Cabinet scrapers	1		Burnisher
4		Spoke shave	1		Combination bevel and plumb
2		Miter saws	2		1-in. rabbet planes
2		Philips screw drivers	1		6-in. monkey wrench
7		Assorted screw drivers	1		14-in. monkey wrench
3	6-ft.	zigzag rules	1		Shoot board
1	pr.	10-in. carpenter's pincers	1		Miter clamp
			1		¼-in. electric drill
			1		Miter box (adjustable)
			1		Portable belt sander
			1		Circular glass cutter
			2	sets	wood-turning tools
			4		8-in. draw knives
			2		Braces
			1		Breast drill
			2		Hand drills
			2		24-steel squares
			12		Coping saws

Fig. 10. Counterbalanced blackboard

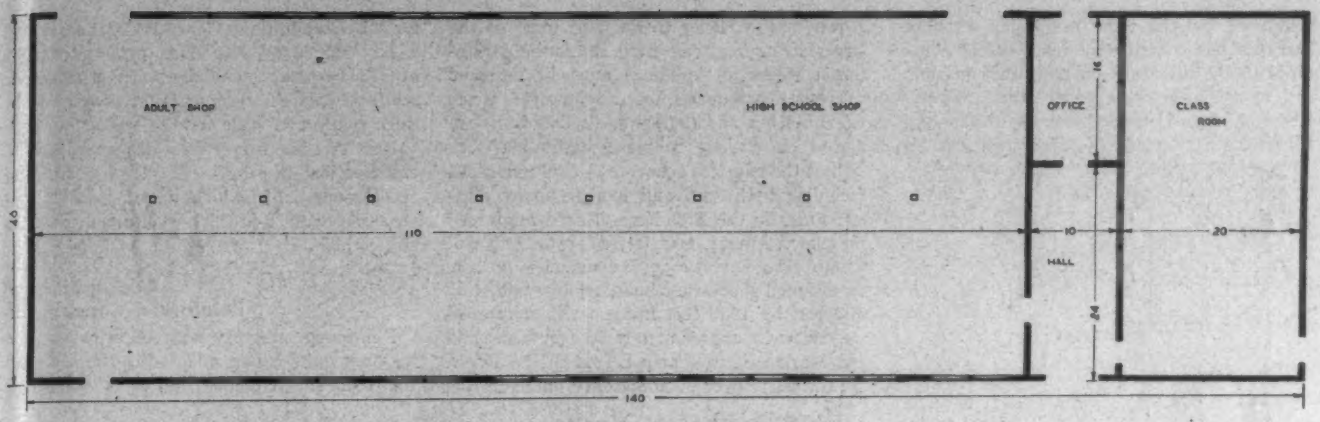
The Shop at the Minidoka Project

*Oscar F. Cutkowsky**

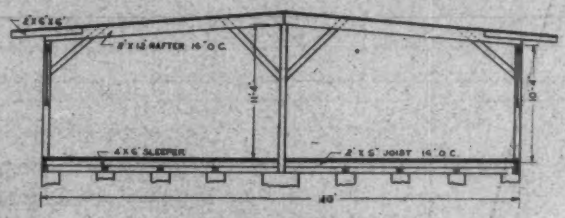
Industrial-arts teachers in any school today are facing the problems of securing instructional material. Due to war restrictions these are, to a large extent, unobtainable. Here at the Minidoka Relocation Project, we also must justify the use of any critical material for a particular need. Lumber, solely for instructional use, is simply not obtainable. With this restriction in mind, a course in carpentry was offered in the fall of 1943, to take the place of the traditional industrial-arts courses. The curriculum was planned in such a way that senior shop classes were held either for the full morning or the full afternoon. Students at first built such small buildings as A type hog house for use on the farm. As their abilities increased, larger construction projects were undertaken. Very soon the need for housing the industrial-arts activities for the school became apparent. A building for this purpose had been authorized, the materials had been purchased and the plans had been prepared for over a year, but due

School shop, Minidoka Project, Hunt, Idaho

*War Relocation Authority, Minidoka Project, Hunt, Idaho.



Minidoka high school shop



Section through shop

Starting the building

to the lack of labor this project had been delayed because the need for other facilities on this project was more urgent. With the success this class had shown in the completion of smaller tasks, the question arose whether this larger task of constructing the school shop was within the capabilities of these two classes. These classes had an average enrollment of ten, one group meeting in the morning and the other in the afternoon. After much deliberation the task was undertaken.

Much has been written about the evacuation of the Japanese from the West Coast to relocation centers. In this article we are only interested in the make-up of this particular group of boys through whose efforts this building was completed. In age they conform to any typical senior high school group, ranging from 16 to 18 years. None of these students had any previous experience in the building trade, nor were their parents in any way connected with this vocation. Their parents, to a large extent, were keepers of small shops or maintained small truck farms. All of the boys had been born in the United States. Prior to evacuation, they had received their education in the regular public schools, and in all respects they are citizens of the United States, like your boys and mine.

All the work in the construction of this building was done exclusively by these boys, and all the guidance they received was that of one shop teacher. The leveling of the building site, hauling the sand and gravel, the painting, as well as the carpentry work has all been the product of their endeavors.

Reinforced Brick Masonry—Its Values in School Building Construction

Harry C. Plummer[1] and E. F. Wanner[2]

Reinforced masonry is brick or tile construction in which steel reinforcing rods have been embedded and are so placed that they will resist tensile and bending stresses developed in the structure.

By combining reinforcing steel with the masonry, the properties of tensile and bending strength are greatly increased in the construction which permits its use for columns, beams, floors, and walls that may be subjected to lateral or eccentric forces. Such properties of brick and tile masonry as compressive strength, fire resistance, and durability are well known and have been demonstrated by both laboratory tests and the satisfactory performance of structures over periods of many years, and through the use of reinforced masonry the designer may utilize these properties and at the same time obtain a structure highly resistant to bending forces but similar in appearance to the conventional types of brick or tile construction.

The use of reinforcing steel in combination with masonry is not new. In fact, it was discovered over 130 years ago by the eminent British engineer, Marc Isambard Brunel. However, prior to about 1922 little effort was made to assemble a record of the performance of reinforced masonry structures or to establish design formulas and working stresses suitable for use in the design of structures.

In 1922, Mr. A. Brebner, Under Secretary of the Government of India, Public Works Department, published a report in two volumes entitled "Notes on Reinforced Brickwork" in which he describes the brick masonry construction built by the local Indian government, and suggested formulas for the design of reinforced masonry.

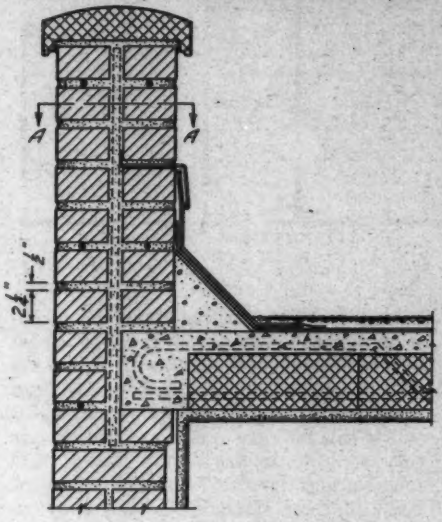
Subsequent research sponsored by the Brick Manufacturers Association of America and

[1]Director of Engineering and Research, Structural Clay Products Institute, Washington, D. C.
[2]Research Engineer, Structural Clay Products Institute.

continued by the Structural Clay Products Institute has contributed much valuable material to the literature on reinforced masonry and in 1932 the Reinforced Brick Masonry Research Board, predecessor of the present Structural Clay Products Research Board, was grown rapidly. Prior to the war, most of the larger structures were built in southern California where all buildings must be designed to resist earthquake forces; however, since Pearl Harbor and the emphasis that has been placed on designs to resist bomb blast, as well as the effort to conserve critical materials, including both steel and lumber, many large structures in the East have utilized reinforced masonry. Among the latter are the Naval Bomb Site Factory at Indianapolis, an air-conditioned windowless building; approximately 500 feet by 1000 feet in area with reinforced curtain walls approximately 50 feet high; and the Marine Corps' Camp Lejeune, New River, N. C., where over 6000 masonry lintels having spans of from 3 to 12 feet were constructed of reinforced masonry.

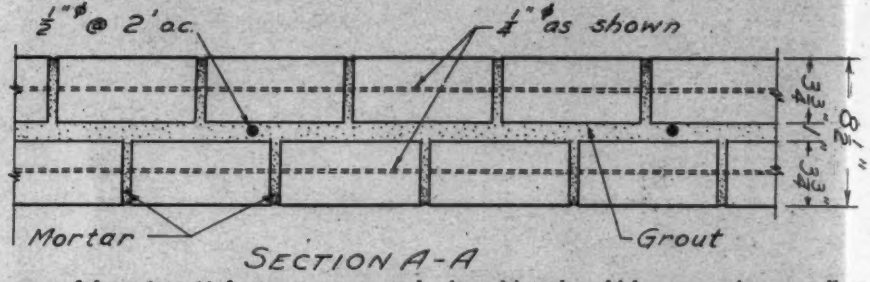
Reinforced brick masonry has also been used for the construction of rural housing in Baruch Corporation, General Contractors, at a cost of $2,004,000. This project consists of 112 two-story buildings with 8-inch-thick reinforced walls for the first stories and 7-inch-thick reinforced walls for the second stories.

Reinforced masonry was also used for the construction of the Walt Disney Studios, Hollywood, Calif., which is wall bearing construction with 8-in-thick reinforced walls, 3 stories high.



R.B.M. PARAPET WALL

Figure 1



SECTION A-A

Adaptability of Reinforced Construction

Reinforced masonry built of brick or solid masonry units is best adapted to the construction of beams, columns, and walls which may be subjected to high compressive as well as bending stresses. Reinforced hollow masonry is adaptable to the construction of floors or the walls of circular storage structures such as

R.B.M. STEELTYD CONSTRUCTION

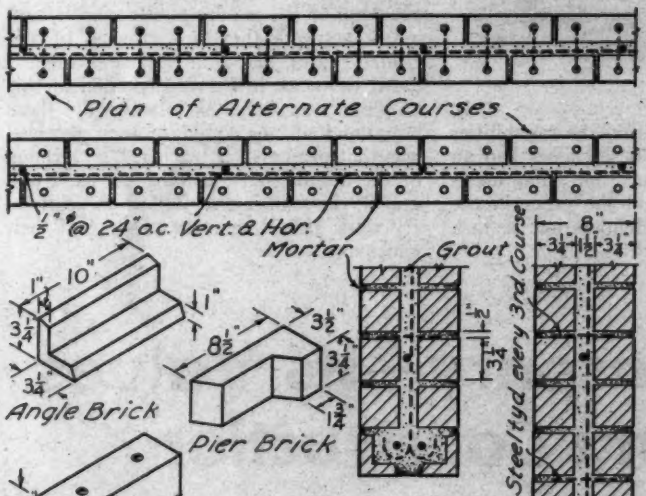


Figure-2

R.B.M. GROUTLOCK CONSTRUCTION

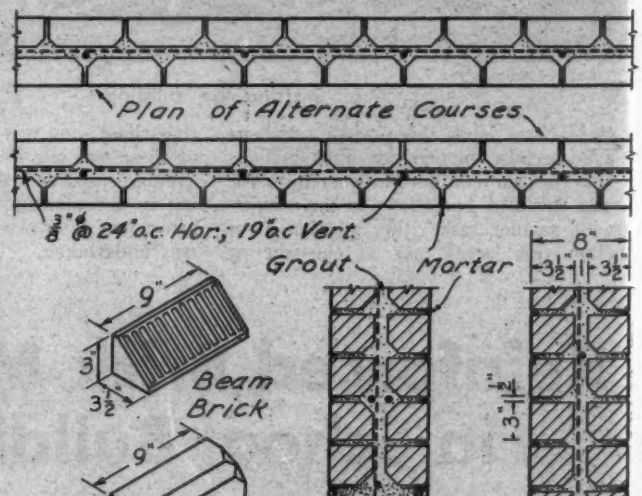


Figure-3

organized. This board is composed of masonry experts from engineering schools, outstanding consulting engineers, and other authorities on structural engineering. A comprehensive research program has been outlined, and the board has done effective work in directing and co-ordinating tests on masonry materials, and on both plain and reinforced masonry.

Modern Developments

During the past 10 years the use of reinforced brick masonry in this country has Mississippi where it was found that the cost of the reinforced brick homes was less than similar designs in frame.

During the past few years hundreds of thousands of square feet of precast reinforced tile floors have been installed in hospitals, housing projects, schools, and similar structures. The school building at Burlington, Iowa, constructed in 1937, designed by Holabird and Root, Chicago, Ill., with tile floors is typical of this construction.

Recent projects constructed in California include the FPHA Ramona Gardens Housing Project at Los Angeles, designed by Housing Architects, Affiliated, and constructed by silos and bins in which the principal stresses are tensile.

For school-building construction, reinforced masonry is particularly well adapted for parapet walls, lintels, spandrel beams, columns, retaining walls, and floors.

Parapet walls are one of the most vulnerable elements of the average masonry structure. Being exposed to the weather on both sides, the masonry is subjected to frequent cycles of freezing and thawing and if, as often happens, the coping is not watertight, excessive amounts of water may enter the masonry. The situation is further aggravated due to the relative inaccessibility of the parapet and the

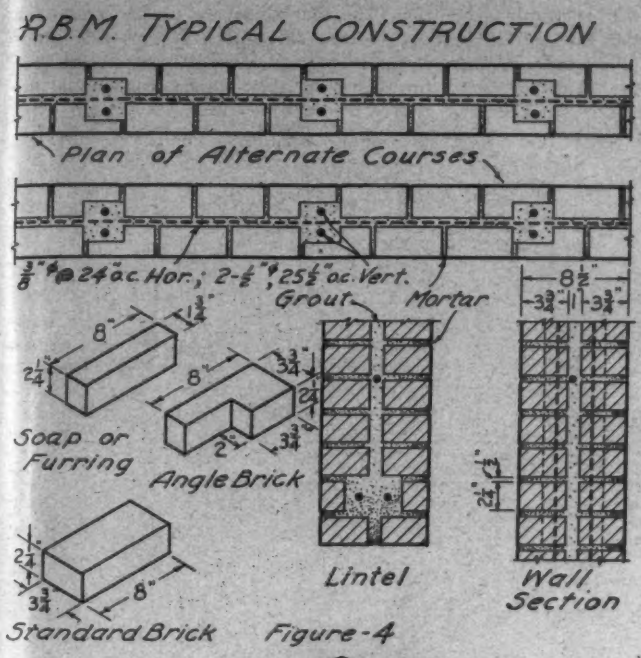


Figure - 4

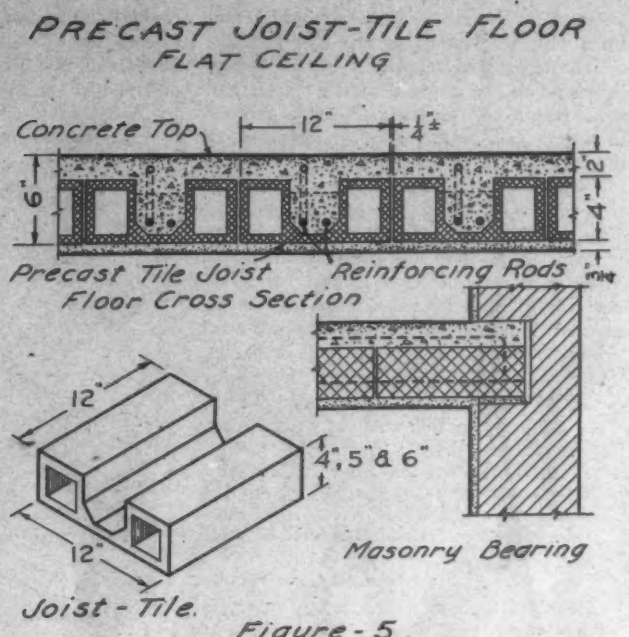


Figure - 5

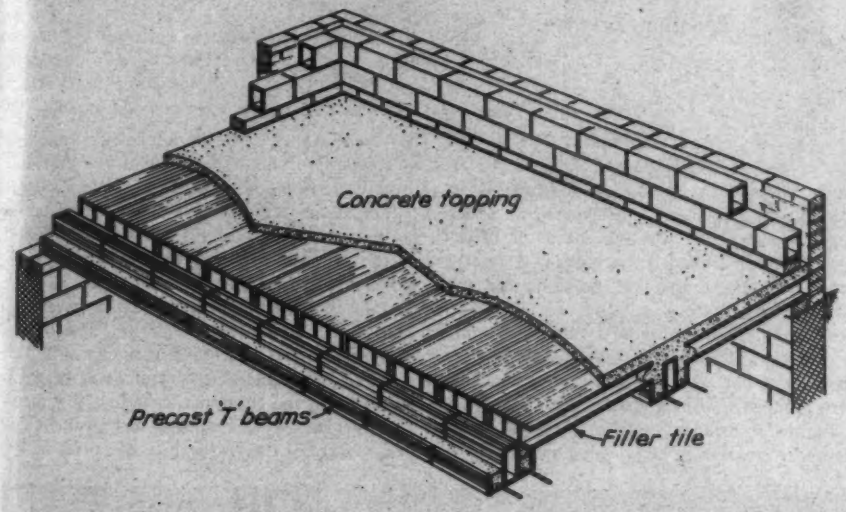


Figure 6

resultant lack of maintenance in the form of pointing mortar joints, either in the coping or the parapet wall itself. As a result of severe exposure and lack of maintenance, copings and sometimes the brick from the parapet wall become loosened and may create a serious hazard during periods of high winds.

Reinforcing steel in the parapet walls, as illustrated in Figure 1, will resist movements of the masonry due to temperature changes or other slight movements of the structure and is cheap insurance against the danger of masonry falling on to the school ground.

Beams and columns which form a part of the exterior wall can be constructed of reinforced masonry which is bonded into and made a part of the exterior wall.

Lintels of reinforced brick or tile masonry are cheaper than most other types and also contribute to more watertight construction, since the lintel is built as an integral part of the wall. Experience indicates that the mortar joint in which a steel-angle lintel is placed or the joint between various types of precast lintels and the masonry is difficult to make watertight, and that leakage frequently occurs at this point. The reinforced masonry lintel requires no painting and can be relied upon to give satisfactory service for the life of the structure.

Frequently retaining walls are used in the development of school property and, where these walls are constructed of reinforced masonry, they can be built of materials which will harmonize with the school buildings and enhance the general appearance of the school grounds.

Reinforced brick masonry can also be used effectively in the construction of basement walls or the walls of boiler rooms; the latter of which may be from 15 to 20 feet high. It is recommended that reinforcement (one ½-inch round rod in 8-inch-thick walls and two ½-inch round rods in 12-inch-thick walls) be placed around all openings to prevent cracking of the masonry which may result from unequal distribution of stress or uneven settlement of foundations.

Precast reinforced tile floors or combination tile and concrete joist floors have been used extensively in the construction of school buildings and are particularly well adapted for this purpose. In addition to their fire safety they have greater rigidity than many other types of floor, which not only gives lateral support to the building but reduces vibration due to movement of the occupants. Tile floors have also been found to be less subject to volume change during and after setting than solid concrete slabs.

Cost and Design Values

California contractors who are familiar with the construction of reinforced brick masonry consistently submit lower bids on walls of reinforced brick than of reinforced concrete. This difference is due primarily to the savings effected by the elimination of forms for vertical walls. The elimination of forms also conserves lumber and this factor may be expected to be an important consideration for postwar construction. Masonry contractors who have built reinforced masonry structures state that the difference in the cost between reinforced and unreinforced masonry is little more than the cost of the reinforcing steel used.

Reinforced masonry is designed to resist bending as well as compressive forces and it is essential that all joints in the masonry be completely filled. The method recommended for accomplishing this is to fill all interior joints with grout which is obtained by adding sufficient water to the mortar to give it a fluid consistency.

Since strength is usually of primary importance in reinforced masonry structures, only high strength mortars are recommended. The American Society for Testing Materials' specifications for mortar for reinforced brick masonry require a mixture of one part portland cement, one-quarter part hydrated lime, and three parts sand by volume. This mortar has been used extensively in the con-

struction of reinforced brick masonry structures with very satisfactory results.

The strength of reinforced brick masonry is related to the strength of the mortar and the strength of the brick. Working stresses in flexure and bearing are best obtained by determining the compressive stress of prisms of masonry built of the same brick and mortar that will be used in the construction, and then basing these working stresses on the ultimate compressive strength of the masonry. Working stresses of from 25 per cent to 33 per cent of the ultimate strength are recommended. Working stresses for shear and bond are based on tests of full-size walls or beams. The Uniform Building Code of the Pacific Coast Building Officials Conference, 1940 edition, includes the following working stresses for grouted masonry:

Shear (no web reinforcement)	30 psi.
Shear (with web reinforcement taking entire shear)	60 psi.
Bond (deformed horizontal bars)	80 psi.

A Typical Construction

Figures 2, 3, and 4 illustrate three types of reinforced brick masonry construction, all of which were developed in southern California. In 1937, the Los Angeles Vermont Avenue School was constructed of reinforced brick masonry using units of the type illustrated in Figure 4.

This school was designed by the architects of the Los Angeles board of education and Mr. Charles A. Fork, consulting structural engineer. In an article describing this project, Mr. Fork states:

"The new Vermont Avenue School in Los Angeles, Calif., is an outstanding example of what can be done to make brick construction safe in an area subject to earthquake shocks.

"The east and west wings of the schools are two stories high, connected in front with a one-story unit. The horizontal floor area is 38,700 square feet. Total cost of the building proper was approximately $180,000 or $4.62 per square foot of floor area. The school cost less than a similar job of concrete. This is significant in view of the fact that face brick were used to face the 13-inch exterior walls and interior corridors.

"Unusual features in this school are the use of shaped brick, and the grouting method for filling the interior joints.

"The walls are distinguished from the usual type of reinforced brick masonry in that definite channels are provided for a grout core around the reinforcement. This is accomplished by the use of three different brick shapes; the standard unit for general filler purposes, the ¾ unit to provide grout space for the vertical reinforcement, and the ½ or narrow unit to provide grout space for horizontal reinforcement.

"By the use of these units, it is possible to place the reinforcement nearer the faces of the wall, and thus increase its effective depth. Greater assurance of securing a good bond between steel and masonry is obtained by the large grouting space. A very notable feature of the ¾ unit is its extreme flexibility for accommodating any spacing of vertical reinforcing bars. The bar spacing need no longer be in multiples of brick dimensions. If the unit laid in the usual manner does not clear the bar, the unit is simply reversed, thereby moving the channel 4 inches forward. One unit provides a 4-inch channel, while two units placed adjacent to each other provide an 8-inch channel. In general, it is advisable to maintain a maximum bar spacing in order to provide sufficient working space for bricklaying. In this job, a spacing of 2 feet 2 inches was used, wherever possible, for the vertical bars, and a spacing of 2 feet 0 inches for the horizontal bars. When it became necessary to increase the steel area, either the size of the bar was made larger or the bars were grouped two in a channel."

Figures 5, 6, and 7 illustrate typical types of precast reinforced-tile-beam floor construction. The tile beams are usually precast at the building site, although some tile manufacturers precast them at their plants for projects where they can be economically delivered by truck.

Extensive tests have been made of precast tile floor beams, some of which are reported in Research Bulletin No. 236 of the Agricultural Experiment Station, Iowa State College.

Indications are that the use of reinforced masonry construction will continue to expand in the postwar era and the Structural Clay Products Institute is now devoting a large part of its research program to an investigation and study of methods of design and construction of reinforced masonry. As this research is completed, the results will be made available to the construction industry through publications of the Institute, technical articles and reports of the research laboratories.

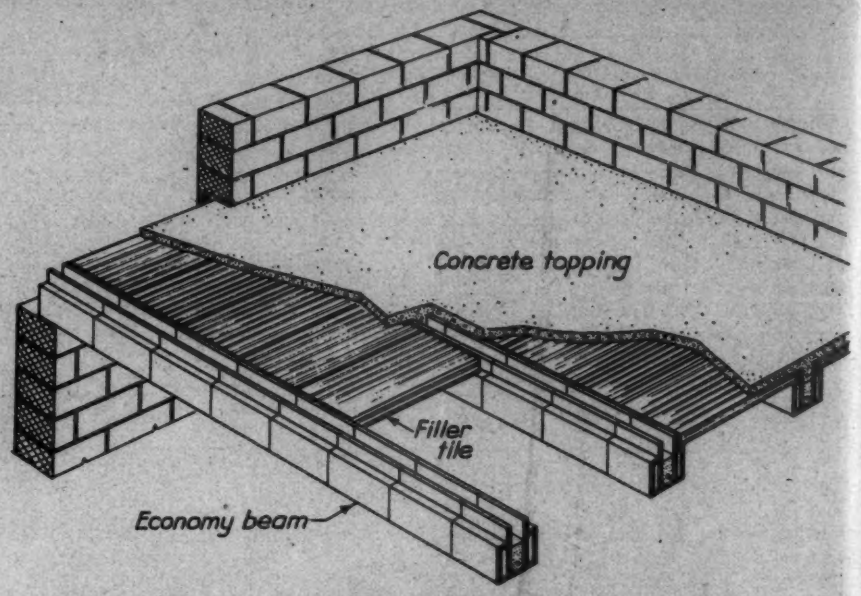


Figure 7

Architectural Drafting Department of the George A. Davis Vocational and Technical High School, Grand Rapids, Mich.

Combination Planning and Work Station for Industrial Arts

*G. Harold Silvius**

In Detroit, planning is recognized as an integral part of the activity in industrial arts. Students plan their projects before they build them. On the early levels, the typical projects are cooperatively planned by group participation under the guidance of a skillful teacher. As students progress, they apply the fundamentals in planning on a highly individualized basis. The *Student Planning Book* is being used generally for this purpose.[1]

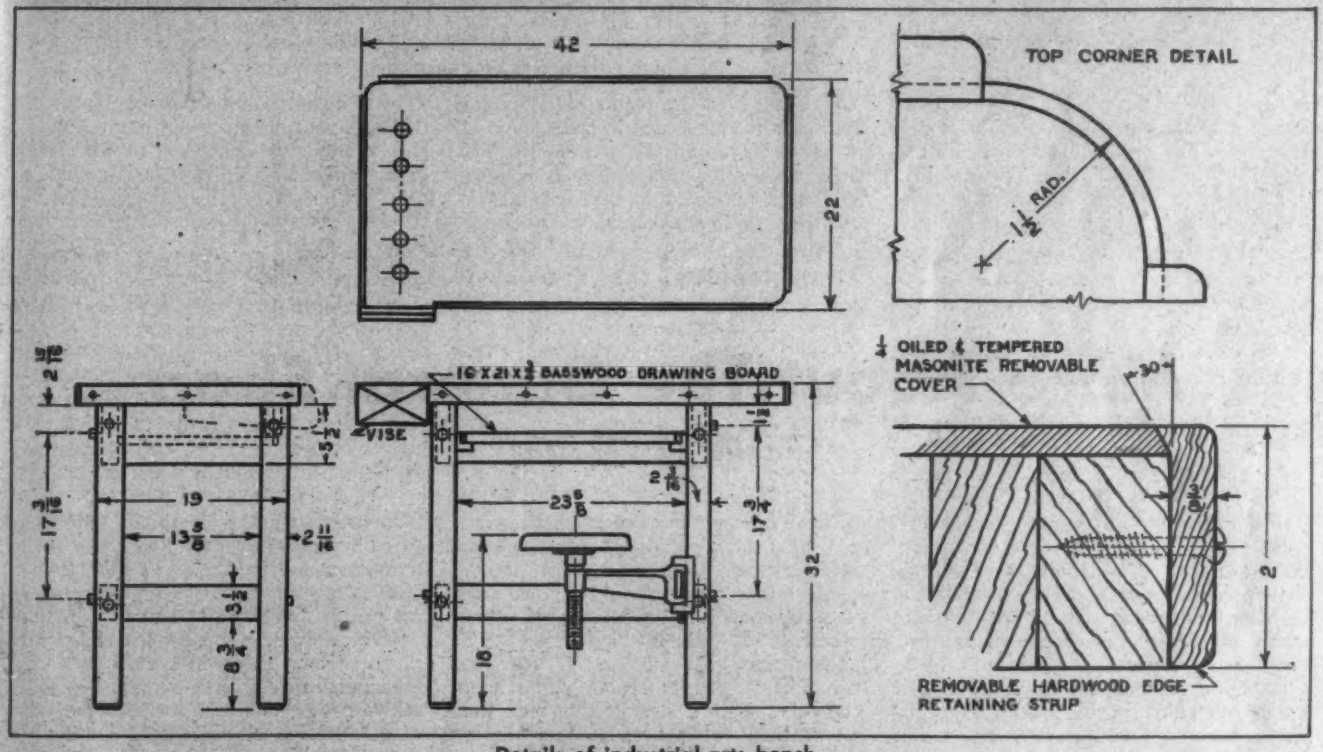
top can be replaced every 4 or 5 years for a cost of approximately 75 cents. The maple bench top is also suitable for use without the masonite covering.

2. The legs and frame of the bench can easily be repainted by students at regular intervals. This frame becomes a splendid project for teaching the instructional unit, *How to Apply Paint*.

3. The drawing board is easily stored and replaced.

of at least 30 in. and with at least two bolts in each top. Bolts to be ½ in. in diameter with 1-in. diameter flush fillister nuts. Corners shall be rounded on 1½-in. radius. The maple top under masonite shall be finished natural color and varnished two coats.

In addition, a sheet of ¼-in. tempered masonite the exact size of the wood top shall be provided with edges beveled as glued with waterproof glue. Tops to be re-



Details of industrial-arts bench

It is not always possible to find enough room in an industrial-arts shop so that a separate area may be set aside to seat a class while they plan their work. The Research Department of E. H. Sheldon and Company at Muskegon, Mich., were contacted regarding the possibility of developing an inexpensive combination planning and work station. Several models were made and tried out before the combination bench was adopted for use in the Detroit schools.

A few of the outstanding features of the combination planning and work station are:

1. The ¼-in. oiled, tempered masonite

4. The swinging stool is also useful for such work as linoleum block cutting, tooling leather, and chip carving.

5. The stool may be adjusted for height.

The Detroit schools purchased through competitive bids the specifications for the combination planning and work station are as follows:

Bench shall be 42 in. long by 22 in. wide by 32 in. high, overall. The working surface shall overhang base cabinet approximately 7 in. at either end to provide for mounting woodworking vise.

Bench top: Material shall be selected edge grain maple, kiln-dried to a moisture content of not more than 4 per cent by weight. Top shall be solid type without so-called *tool well* and shall be fabricated of 1¾ in. thick narrow strips, thoroughly inforced with cross tie bolts at intervals

detailed and shall be held in place on the top surface by means of maple strips ½ in. thick by 2 in. wide, machined as detailed. Strips to be fastened to the edge of maple top with oval head plated screws. Tempered masonite shall be oil finished and retaining strips shall be finished school brown.

Bench dog holes for ¾-in. shank dogs shall be bored through both the masonite cover and the wood subtop at 3½-in. intervals crosswise of the top at one end and in line with the center of the top edge of the vise jaw.

The base cabinet shall be fabricated of selected maple. Legs to be 1⅝ by 2 11/16

*Assistant Professor and Supervisor of Vocational Education, Wayne University, Detroit, Mich.

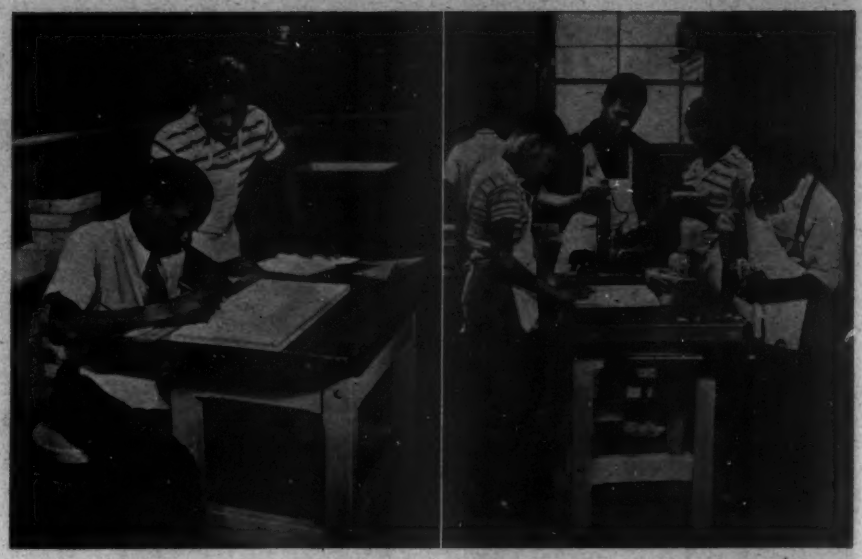
[1]Gerald Baysinger and G. Harold Silvius, *Student Planning Book for Industrial Arts and Vocational Classes*, International Textbook Company, Scranton, Pa.

in., apron rails to be 3½ by 1¼ in.; brace rails to be 3 by 1¼ in. All joints to be mortised and tenoned and further reinforced by 5/16 by 4½ in. squarehead machine bolts.

Each bench shall be provided with an attached adjustable stool, securely bolted and screwed to the right front leg as detailed. The adjusting screw for the stool bracket shall be accurately machined from H.R. steel stock 1 in. in diameter and 6 in. long. The hook, arm, and seat plate shall be cast gray iron, the entire assembly to weigh not less than 7 lb.

The stool seat shall be of maple material at least 11 in. in diameter by 1⅜ in. thick, with the top edge neatly rounded and smoothly sanded all around, and shall be securely attached to the seat plate by at least three No. 14 by 1-in. f.h.b. screws.

The bench shall be further equipped with a continuous screw parallel bar vise fitted with wood handle and provided with metal dog in front jaw, so designed that it cannot be removed without the use of tools. The vise shall open 10 in. and have a jaw not smaller than 3 by 7 in. with a minimum weight of 30 lb. for the completed vise. The continuous screw shall be 1 by 18½ in. finished size. The parallel bars shall be ⅞-in. stock and shall be tied at the outer ends by a heavy yoke to hold the alignment.



A comfortable planning station. The adjustable stool swings under the bench for manipulative work

Provisions shall be made for storing a basswood drawing board ¾ by 16 by 21 in., below the apron rail as detailed. The ¾ by 16 by 21-in. board shall be provided with this bench as specified.

Benches shall be finished in shop gray to match selected color as specified. The stool castings shall be painted black and the stool seat shall have a natural finish. Heavy angles with screws, together with expansion shields, if necessary, shall be provided for securely fastening the benches to either wood or composition floors, one angle to each leg.

More About The General Shop

*Harold L. Forsea**

During the recent years of rapid expansion of industrial arts the general shop has grown up as a definite part of the whole program. A great deal of information is being assembled concerning various phases of the general shop; comparative studies help to indicate progress and trends. The following is a condensed report of such a study[1] in which specific general shop programs were surveyed during the school year 1942–43.

The majority of indications point to the general shop as rendering its greatest service at the junior high school level and in the small schools. Hence, the investigation is stressed in these two areas by gathering the data principally from one-teacher shops, representative of the two groups.

A selected list of one-teacher general shop programs was obtained through the recommendations of industrial-arts department heads in teacher-education institutions. These recommended programs were surveyed by questionnaire to obtain pertinent data about certain phases of general shop practices.

The information from 127 cases, from 14 states west of the Mississippi River, represents 22 junior high schools, 57 junior-senior high schools, 37 four-year high schools, and 11 senior high schools. The other eight states in this area were not reached either because they do not maintain teacher-education centers for industrial-arts education or because the institutions contacted did not respond to the initial request for a list of schools.

The junior high and junior-senior high schools together total 79, or 62 per cent, of the cases. On the basis that these schools were selected by the recommendations of leaders in the field, this situation definitely indicates that the predominance of general shop programs is in schools with grades 7, 8, and 9. A very significant representation is accorded the six-year high schools.

Origin and Age of the General Shops

A comparison of the origin of the shops shows that a slightly greater number (66) had been reorganized from unit shops while 54 were planned and established as new general shops, as reported by 120 instructors.

In comparing the lengths of time these shops have been in operation, it was found that about half (51.5%) of the reorganized shops were under ten years old; 74 per cent of the *new* shops were in this age bracket, showing a significant trend toward planning new shops in preference to reorganizing an established unit shop. This ten-year time unit also includes the years of great financial depression. During the period 11 to 20 years ago, 24 reorganized shops and only 10 new shops were put into operation.

Here is shown a coming realization that a general shop is not merely the bringing in of a few extra tools and materials, but requires a definite planning to meet objectives peculiar to that type of organization.

Variety of General Shop Offerings

The 127 general shop programs report a total of 54 different industrial-arts experience areas offered. This total is considerably larger than that reported in other earlier studies, and, although some areas are mentioned only once, it evidences a gradual increase in the variety of industrial-arts offerings. As the total number of offerings increases, the list of the common offering lengthens.

Woodworking continues to be offered more frequently than any other area

*Union High School, Corning, Calif.

[1]Report from a thesis study by the author entitled "A Survey of Certain Phases of Selected General Shop Programs in Secondary Schools West of the Mississippi River" in partial fulfillment of the master of science degree at Oregon State College.

(94.5% for this study). Other prominent areas are mechanical drawing (88%), wood finishing (79%), sheet metal (77%), and electricity (72%).

Bench metal, art metal, and home mechanics appear in about half of the schools (54%, 50%, and 46% respectively). Forging, machine shop, ornamental iron work, carpentry, welding, and leathercraft are found in approximately one third of the cases.

Architectural drawing is offered in one fourth of the schools, with the exception of the junior high schools. Plastics is offered in nearly one fourth of the schools, and is increasing in popularity as are some of the other craft areas.

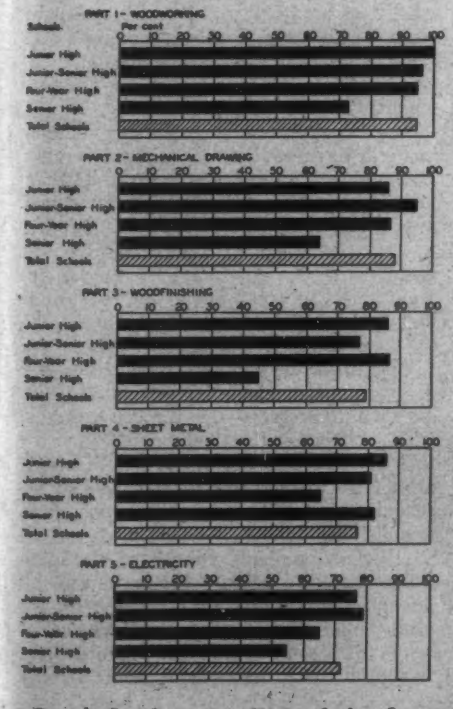
When the general shop offerings are considered by school groups, the same five areas are leading. Graph 1 presents these percentages for purposes of comparison.

Industrial Arts as a Required Subject

The figures in this study show that industrial arts is required for the seventh and the ninth grades in approximately three fourths of the schools reporting; eighth-grade shopwork is required in over four fifths of the schools. There are requirements in over three fifths of the tenth grades and in half of the eleventh and twelfth grades.

Three fifths (63%) of the schools require industrial arts in the seventh and eighth grades, consecutively. This arrangement is practiced in 54.5 per cent of the junior high schools and by 65 per cent of the junior-senior high schools.

Shopwork is required in grades 7, 8, and 9 in about half of the schools. On the same comparative basis this represents 27 per cent of the junior high schools and 58 per cent of the junior-senior high schools. In both of these comparisons the junior high grade levels have stood very high in the matter of required courses. The place of the junior-senior high school in these calculations should not go without notice.

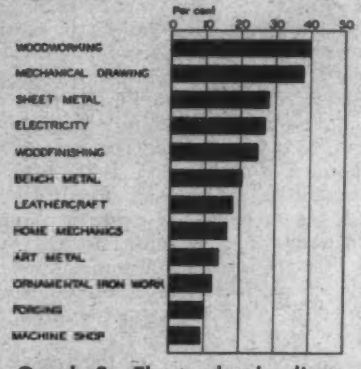


Graph 1. A comparison of the five leading experience areas

The organization of industrial-arts offerings to encompass a broader sampling of industrial experiences, particularly in the lower grade levels, has increased the procedure of required industrial arts for one, two, and three consecutive years. The practice of requiring shopwork in grades 7 and 8 and offering it as an elective in the ninth grade no longer seems to be the common practice that earlier studies have suggested.

Half (49%) of the junior-senior high schools require industrial arts in grades 7, 8, 9, and 10. This may be a result influenced by the defense training program as no equivalent comparisons were found in current literature; or it may be additional evidence of the situation mentioned above.

The schools requiring industrial arts offer a selection of 29 separate experience areas. The 12 most frequently required appear in Graph 2.



Graph 2. The twelve leading required courses

Length of Class Periods

The length of class periods ranges from 40 minutes to 120 minutes, with an average of about 60 minutes. Periods for seventh and eighth grades range from 40 to 65 minutes in length, averaging 56 minutes. The remaining grades range from 40 minutes to 120 minutes in length with an average of about 60 minutes.

Considered by school groups, the periods range from 40 to 60 minutes, averaging 52 minutes, for junior high schools. The periods are 40 to 120 minutes in length for junior-senior high school, and average 60 minutes. The range reported in four-year high school is 45 to 90 minutes, with an average of 61.5; and for senior high school the range is 50 to 120 minutes, averaging 64 minutes. These data are tabulated from industrial-arts classes that meet on a daily basis.

The average *weekly* allotment of time in the different grade levels for classes meeting daily is: seventh grade, 280 minutes; eighth, 281; ninth, 301; tenth, eleventh, and twelfth grades, 304 minutes.

The average weekly time allotments based upon school groups are as follows: junior high school, 261 minutes; junior-senior high, 297 minutes; four-year high, 308 minutes; and senior high, 321 minutes. These averages are somewhat higher than those shown in similar studies and, possibly, show a trend in the scheduling of industrial-arts classes.

There are a few cases where industrial-arts classes do not meet daily. The most common variation is for the seventh- and eighth-grade classes to alternate during the week. Of these few cases the class periods are 40 to 60 minutes, making a weekly allotment of 80 to 180 minutes.

It can be seen that the complete range of time allotment reported is indeed great — 80 minutes minimum to 600 minutes maximum, per week. Although average class periods in the junior high school are relatively shorter, the general practice is approaching the one-hour period. Periods of less than 50 minutes are not as satisfactory when one considers the nature of the subject and the amount of time necessarily consumed at the beginning and the end of each period for the care of materials and equipment.

Time Scheduled for Required Courses

Another phase of time allotment in the general shop is the amount of time scheduled for each required experience area within the course. The complete range reported was a minimum of five hours (one hour daily for one week) to a maximum of 180 hours (one hour daily for 36 weeks). Some of the controlling factors are the number of experience areas taught in one class, the amount of equipment provided, the number of years in which shopwork is required, the general sequence of the required courses, and the emphasis placed upon each area by the instructor. The average time from all grades is 60 hours, the equivalent of one hour daily for 12 weeks. The average time computed by separate grades is: seventh grade, 50 hours; eighth grade, 40 hours; ninth grade, 60 hours; tenth grade, 54 hours; eleventh grade, 78 hours; and twelfth grade, 77 hours.

Relatively more experience areas are taught in the lower grade levels at shorter periods. Longer allotments of time in the upper grade levels permit a greater degree of specialization in each of the experience areas taught there.

Rotation to the Several Experience Areas

Considerable data was collected regarding the rotation of students from one experience area to the next. The requirements of each type of general shop organization are so varied and the requirements of specific shop setups are so different that it is difficult to arrive at generalizations which are typically descriptive. The fact that 72 per cent of the instructors reported using a definite rotation plan of some type indicates the importance of the procedure as a part of general shop organization. No

attempt was made in this study to find what the other 28 per cent of the instructors do to prevent the exploratory route of each student from being a hit-or-miss affair.

The preferences for a plan of rotation of some sort, classified by school groups, are as follows: junior high schools, 65 per cent; junior-senior high schools, 78 per cent; four-year high schools, 67 per cent; and senior high schools, 75 per cent. The current literature does not attack this problem specifically enough to make any comparisons possible; however, there is room for speculation at the differences reported between the junior high schools and the junior-senior high schools since both have the lower secondary grade levels.

One plan of rotation is to require the student to complete a specified amount of work (projects, etc.) before he is eligible to start in another area. This method is used by 68 per cent of the cases as a whole. It is reported most often in the four-year high schools — 73 per cent. Other school groups reported as follows: junior high, 69 per cent; junior-senior high, 67 per cent; and senior high, 57 per cent. In general it would be expected that the preference be highest in the lower grades since the major portion of the required work is done at those grade levels and a closer check should be kept on the pupil's accomplishment of basic fundamentals.

Another variation in the rotation process is that of rotating as groups or as individuals. The less flexible plan of group rotation is based upon time periods determined for each experience area, either according to the emphasis desired upon the particular units or according to the number of areas included in the class. The simplest solution is the case where four areas are taught; the school year is 36 weeks; therefore, nine weeks are spent on each experience area. Like most plans, individuals claim advantages and disadvantages for each. The best interests of the pupil are to receive due consideration in either case, yet the *shifting* process may be done so mechanically that student interest becomes an afterthought.

No definite preferences for group rotation or for individual rotation appear in viewing the data as a whole. Only slight preferences are found when the school groups are considered separately. The junior high schools are about evenly divided, with one case making use of both methods in some manner. The greatest variation appears in the junior-senior high schools as might be expected due to the greater span of grade levels. Forty-four per cent use indivdual rotation, 50 per cent use group rotation, and 6 per cent make use of both plans. This group of schools, in half of which industrial arts is required in grades 7, 8, 9, and 10, registers a preference for the less flexible plan of group rotation. An example of a combination of group and individual rotation was explained briefly in one case where the instructor bases individual rotation largely upon a specific assignment. This permits the faster students to proceed into a different area when the first one is completed. However, at the end of a definite period all the others are placed in new areas even if the first assignment is unfinished. A degree of flexibility is the result.

In the upper grade levels where more electives are permitted and a degree of specialization is more common there is a preference for individual rotation; this choice is 62 per cent for four-year high schools and 56 per cent for senior high schools. Three per cent of the four-year high schools and none of the senior high schools used a combination of both methods.

The individuality of the rotation process really becomes apparent when a study is made of the lengths of the time periods used in rotation. Instructors in 109 schools reported using a definite time period in the rotation plan. The length of this period was reported to vary from 1 week to 12 weeks; not only does this variation exist between schools, but, more specifically, within the same shop. Some use an optional time limit based upon the individual and the project.

The different time periods in common use are — six weeks, nine weeks, and "variable" time. The latter choice correlates with individual rotation. Further than that, it affords a greater or less concentration upon the different experience areas offered, cognizant of such factors as the extent of the facilities, the needs or current demand, and the number of students enrolled. Obviously, if a shop has, as part of its facilities, 16 bench-metal work stations but only one metal-turning lathe and one welding outfit, every boy cannot be given nine weeks' experience at each.

Nearly half (47%) of the junior high schools use a specific nine-week time period in rotation; the other common choices are six weeks, 16 per cent; and variable time, 32 per cent.

In the junior-senior high schools 39 per cent use variable time periods, 31 per cent use six-week periods, and 14 per cent use nine-week periods. The high frequency of the variable time period in this group is explained in part by the extra comments which appeared on the questionnaires; several instructors stated that in the lower grades the rotation time periods were shorter than in the upper grades in the same school. This necessitated an answer of "variable time" for the school.

The four-year high schools are practically evenly divided on the choices.

Of the senior high schools using a specific time period in the rotation the six-week period is prominent in half of them; the other choices were: nine-week, 37.5 per cent; variable time, 12.5 per cent.

A consideration of the several phases does not do justice to the complete process of rotation in the general shop class. Problems remain which are untouched either by current writings or by this study; for example, why should 47 per cent of the junior high schools make most use of a nine-week time period in rotation and only 14 per cent of the junior-senior high schools use the period, when both schools embrace the lower grade levels? Something more than a superficial study of the rotation problems will have to be made on a series of *identical* shops, obtaining very specific data. In the realm of general shop organization this list would be impossible to compile. The process of rotation is just as individual as the particular shop in which it is employed. Such conditions have brought much criticism upon the general shop plan.

These phases of rotation are closely related even though they were considered separately here. An instructor favoring individual rotation may assign a definite amount of classwork to be accomplished. He will govern the amount somewhat by the average time he wishes to emphasize that area; to that extent he is employing a *variable* time period as the emphasis upon the several areas may very likely be different.

The results of the study indicate that some definite plan should be adopted. The main problem still remains to be solved regardless of what combinations are selected: How can the plan be kept operating in the best interests of the pupils and with results that insure the greatest achievement for every boy? To this end rotation in the general shop is a problem of the individual instructor to be solved for his particular shop situation.

Starting the General Shop Class

Another specific problem of the general shop is that of starting the class. Five of Yager's[2] general methods were adapted for the purpose of obtaining ratings from the instructors.

The most frequently used method is that of demonstrating the beginning job in each experience area before the entire class and assigning the membership afterward. This method also was *ranked* first of the three *best* methods by all except the junior-senior high school instructors.

The second most commonly used method is to demostrate the beginning job in a selected area and assign a group to it; then jobs for other areas are demonstrated and pupils are assigned in a similar manner. In the ranking process this method was placed first by the majority of junior-senior high schools, second by the junior high and four-year high schools, and third by the senior high schools.

The third method makes generous use of instruction sheets. The pupils are assigned directly to the respective areas, with written instructions; the instructor follows with demonstrations as the needs arise. This method was ranked third by all school groups, except the senior high schools.

Of other methods considered the plan using student leaders, sometimes from an advanced group, to assist in getting the class under way is the second choice of senior high schools and tied at third place in the four-year high school group. It is in

[2]Yager, Sylvan A., "Methods of Starting a Class in General Shop," *Industrial Education*, Vol. 38 pp. 152–153, May, 1936.

these groups that the leaders will be most easily located and where the most profitable emphasis can be placed upon qualities of leadership and followership.

A method of handling large classes proposes that the class be divided in half and two days be used in starting the smaller groups by any of the above methods. This plan received little mention in the study.

Two additional suggested methods are a combination of the others and modified methods developed by individual instructors. Neither of these categories received particular mention. The "other methods" consist chiefly of supplements to the general plans.

In the light of the flexibility and individuality of the general shop plan it seems logical to expect considerable variety in methods used in starting classes. However, the study shows that 67 per cent of the instructors rely upon one general method to care for all classes. Eighty-five per cent of the junior high school instructors and 82 per cent of the senior high school instructors depend upon this one method. The other two school groups are slightly below the average.

Twelve per cent of the teachers reporting make use of two different methods, and 19 per cent use three methods. The junior-senior high schools and the four-year high schools report the greatest variety in this respect. These groups, embracing both beginning and advanced classes, require a considerable variety of methods if the needs of various classes are to be met at all satisfactorily. Further evidence is the fact that 4 per cent of the junior-senior high school instructors use a battery of four different methods of starting classes.

Methods of starting new classes rank with the procedure of rotation as major problems within the general-shop plan of organization which tax the ingenuity of every general-shop instructor.

Implications

A consideration of the foregoing data and other findings from the survey and of relevant reports in current literature makes the following implications seem justified:

1. The general shop organization appears predominantly in the schools with grades 7, 8, and 9 and in the small communities, although not limited to these areas.

2. A major portion of these general shops is in the junior-senior high schools, where industrial arts is required in grades 7, 8, 9, and 10 to a considerable degree.

3. The study shows that the general shop is performing its greatest service in the "reorganized" secondary schools and that its growth paralleled that of the junior high school. Particularly is this true when guidance and individual differences were accorded considerable attention.

4. Establishing the six-year high school in the small community appears to have some merits. Using the general shop plan with these combined facilities will permit more instructors and a broader program of industrial arts with a subsequent reduction in unit costs. It is a method of combining the services rendered by the general shop organization at the junior high school grade levels *and* in the small localities.

5. There seems to be an increasing requirement for industrial-arts courses; this requirement is approaching the upper grade levels.

6. The *general* aspects of industrial arts, made possible through the general-shop organization, are receiving more attention in the upper grade levels. This does not necessarily mean a trend away from specialization but a broadening of facilities.

7. There is a general trend toward the planning of new general shops in preference to reorganizing old unit shops on a general shop plan.

8. The trend implies both the improvement in and adoption of scientific shop planning, and, probably, a general expansion of more schools to include industrial arts in the curriculum for the first time.

9. Additional evidence of the change in planning lies in the fact that the majority of general shops established 11 to 20 years ago were of the type reorganized from unit shops.

10. The general shop is a *plan* for presenting industrial arts in general education as a definite part of the curriculum.

11. There is considerable overlapping of the operations included in the separate experience areas.

12. Different communities are unlikely to select identical combinations of experience areas; nor are they likely to organize them in the same manner and with the same emphasis.

13. The general shop is not to be a collection of separate units but a plan of organization encompassing experience areas sufficiently related that some of the equipment is shared. One contribution is to impress upon the pupil the interdependability of industrial pursuits.

14. The variety of separate experience areas offered is generally increasing.

15. Woodwork still appears foremost as a general shop activity.

16. Various metals and materials other than wood may very probably enjoy a tremendous popularity after the war, when supplies and equipment are again available.

17. There is a general tendency for industrial-arts classes to be scheduled one hour per day, five days each week.

18. Industrial-arts class periods are usually longer in the upper grade levels. It would be a tremendous step in the right direction if every junior high school offered industrial arts a minimum of 50 minutes daily and the upper grades were scheduled 60 minutes daily.

19. The extreme variety in weekly time allotment for industrial arts does not speak well of the field as a whole.

20. A greater number of experience areas are offered in the lower grades as compared to the upper grades. Hence, the length of time spent in each area in the lower grades is proportionately shorter.

21. There is considerable variation as to the amount of time devoted to the separate experience areas among the various schools. The individual situation involves too many variable factors to result in any great degree of standardization, with the exception of the five or six more common experience areas.

22. The woodworking bench is the most common type of work station provided.

23. The combination type of bench has not yet received general acceptance. Preference still remains with benches adapted more specifically to each type of work.

24. Two specific and difficult problems of the general shop are: rotation of pupils among the experience areas, and methods of starting a new class.

25. The procedure of rotation appears with great variation and with little general agreement in any particular school group.

26. The study of rotation implies that it is an individual problem in practically each general-shop setup.

27. It behooves each general-shop instructor to study the aspects of the rotation process very carefully and to adopt a procedure that will prove a useful tool in meeting the definite objectives of his general shop. These definite objects should evolve from a study of the general purposes and philosophy of the general-shop concept.

28. There are indications that it depends upon the particular type of general-shop organization being used whether or not an entire beginning class is kept in the same experience area for the first period of instruction.

29. Methods of starting a general-shop class revolve rather closely around four of Yager's general methods: (*a*) Demonstrate the beginning job in each experience area before assigning the pupils. (*b*) Demonstrate the first job in one area, and assign a group; then demonstrate another area, assign a second group, and so on. (*c*) Assign the pupils directly to the experience areas, depending upon written instruction sheets to present the necessary preliminary operations. (*d*) Assign the pupils to the areas and use a group leader, preferably from an advanced class, to handle preliminaries until the instructor can get around. This latter plan receives greatest use in the upper grade levels of the secondary schools.

30. The majority of instructors rely upon but one method for starting a general class. Yet, the nature of the general shop demands a considerably greater expression of ingenuity.

A Unit Inventory System

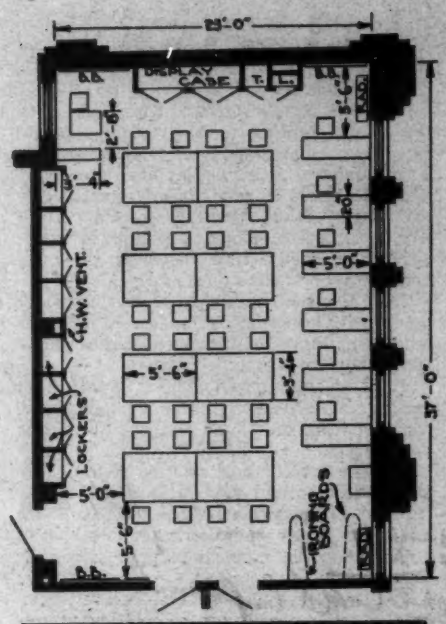
*A. P. Mattier**

The method of keeping a complete permanent equipment record described herewith will be found useful in either large or small school systems. It was originally designed for a system which includes five junior high schools of four buildings each, and a high school and junior college plant which occupies 18 buildings. The system has been found to be simple, efficient, and economical.

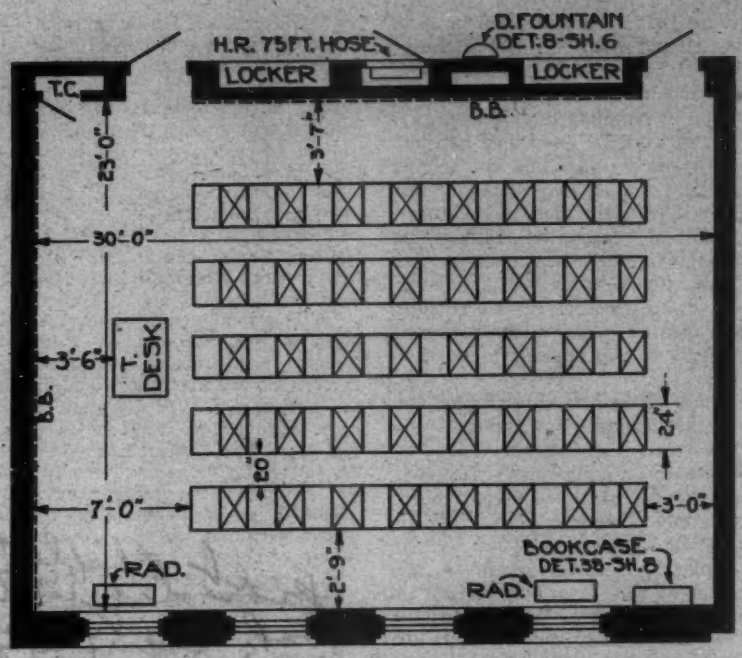
*Compton, Calif.

Detailed Explanation

The rooms in each school should be numbered. It is better that a room be permanently identified by a number rather than by a subject, or by the purpose for which the room is used. Rooms are often used by different teachers and for different purposes, hence, numbering them perma-



ARTICLE	NO.	COST
Chairs	39	2.70ea
Tables	8	14.00"
Sewing Machines	6	20.00"
Waste Baskets	2	.60"
Radiators	2	32.00"
Ironing Board	2	4.00"



ARTICLE	NO.	COST	ARTICLE	NO.	COST

Fig. 1. Floor plans to be used for inventory purposes

nently avoids all confusion. Start numbering the rooms at the left just inside the main entrance. Number the first room 1, the next 2, and so on down to the left end of the corridor; then cross the corridor and continue numerically on to the right, back to a point opposite the starting point. If it is a multiple story building, consider the head of each stairway as a starting point for each floor. If there is more than one stairway, start at the left one. Always number from left to right in each building and on each floor. All rooms should be numbered numerically for each school, starting with No. 101 on the first floor, No. 201 for the second floor, No. 301 for the third floor, etc. Offices adjoining classrooms and small storerooms should be numbered the same as the rooms which they serve. Designate them by a number and a letter, thus 101A, 101B, 102A, etc. All numbering should first be done on the blueprints from which the buildings were built; then the rooms should be numbered to correspond to the blueprints. This helps to avoid mistakes.

The next step is to prepare a separate floor plan for each room, as shown in Figure 1. This is an excellent project for any high school mechanical or architectural drawing class.

One tracing should be made of each room and five Ozalid prints of each tracing. The five complete sets of individual floor plans for our system were then placed in a separate loose-leaf binder. This gave us five sets of plans for each of the six schools in the district.

The principal of each school was then given one set to serve as his inventory of permanent equipment, showing the exact location of all such equipment in his school. One copy is posted in each room for the information of teachers and other employees. One copy is kept in the receiving room or district storeroom. The receiving clerk enters each piece of permanent equipment on the proper floor plan as soon as it is delivered. One copy is kept by the business manager for a ready reference as to information concerning each room in the school system. The fifth copy is given to the one in direct charge of maintenance work.

The size of each sheet in these binders is 8½ by 11 in. If the form does not have sufficient ruled lines for listing all permanent equipment that may be used in any one room, supplementary sheets may be attached to the floor plan.

One great advantage of this unit inventory system is that it simplifies the big task of taking the necessary annual inventory by reducing the job to that of checking the equipment in each room against the receiving room copy, which is at all times accurate and up to date.

To meet the future needs in the industrial-arts field requires:

1. Increase emphasis on analytical thinking during work.
2. Give more attention to skill and workmanship.
3. Keep modern on materials and processes.
4. Industrial arts made more universally available.
5. Closer co-ordination maintained between industrial arts and other school subjects including vocational education.
6. Teachers have more knowledge of related sciences.
7. Encouragement of more bright ambitious boys to become teachers of industrial arts.

— Arthur B. Mays

The barrels of our Army Air Force rocket guns — the flying bazooka — are made of paper treated with heat-resistant plastics. — *American Forest Products Industries, Inc., Washington, D. C.*

Heat-Treating in the School Shop

*A. E. Widdifield**

The one thing that impresses an observer of classes in the vocational school shop at the Samuel Gompers Industrial High School in New York City is the fundamental industrial practicality of the course. Students learn heat-treating and metalworking principles by actually doing the work themselves under the close observation and instruction of an expert in this field.

Their instructor, Walter Schumacher, stresses the industrial uses and application of the basic theory, and has both the laboratory and shop equipment to give every student an opportunity to be on familiar terms with the operation of all standard types of industrial furnace equipment.

The 10 weeks' course covers three main classifications of metalworking:

1. Forging and heat-treating together with the production of such items as cold chisels and screw drivers, and the like.
2. Correct temperatures and their control in heat-treating operations such as hardening, tempering, normalizing, metal melting, and annealing.
3. Surface hardening operations such as carburizing, pack hardening, and the like.

In the lab, the standard types of hardness tests and inspection methods are studied along with microscopic examinations of grain structures resulting from various heat-treatments and working of the metal.

Because a number of small Stewart furnaces have been designed for efficient production heat-treating in small shops and tool rooms, they are widely recognized as standard equipment for all types of industrial heat-treating and vocational training work.

The installation at the Samuel Gompers Industrial High School is a good example of a well-organized practical school shop that has been getting results in output of trained men for a number of years.

Another impressive school shop installation in New York City is the one at the

Fig. 3. The laboratory shown is equipped with a Rockwell and a Brinell hardness tester, microphotographic camera, Monotron hardness tester, Riehle tensile hardness tester, a bench microscope, an engine lathe, and a three-spindle polishing machine. Fig. 4. The current exhibit in the lobby of the Samuel Gompers Industrial High School, showing assorted tools, cast iron, aluminum, bronze, copper, brass, stainless steel, and other parts which students have heat treated in the Stewart furnaces

Fig. 1. The heat-treating line in the school shop of the Samuel Gompers Industrial High School, New York City — Walter N. Schumacher, instructor. The line includes 9 Stewart forges for general blacksmith work and tool dressing, 4 Stewart triple-purpose combination furnaces, each with its own turbo compressor and automatic shut-off valve, 3 Stewart soft metal melting furnaces, and 3 Stewart bench forges. Fig. 2. This section of the school shop shows students working with a Stewart oven furnace, a quench tank for hardening (left), a Stewart brazing table (center), and a Stewart salt bath hardening furnace (right)

*Chicago Flexible Shaft Co., Chicago, Ill.

Machine and Metal Trades High School, where 4 Stewart Triple-combination furnaces, 12 Stewart bench oven furnaces, 1 Stewart double-deck high speed steel preheat and high heat furnace, 2 Stewart semi-muffle oven type furnaces, 3 Stewart direct-fired forge furnaces, 6 Stewart semimuffle oven furnaces, and other standard Stewart units provide the equipment with which heat-treating fundamentals are taught.

Vocational Electric Shop

*S. T. Hammond**

Six years ago San Bernardino Senior High School established an electric shop in the mechanics-arts department of that institution. At that time the war, with its insatiable demand for craftsmen, was not yet upon us. It was thought, however, that the projected plan of expansion of the already well-established vocational training program could be more completely rounded out by the addition of such an activity.

The program then included such other divisions within the department as the auto shop, the machine shop, the pattern shop, wood shop, print shop, and mechanical drawing. In later years carpentry and paint shop have been added, so that today San Bernardino High, though not as large as some, ranks high among the many fine vocational schools of the state in co-ordination, training, and placement of its students.

In the beginning no definite form of electrical curriculum had been established, no placement survey had been made, and no plan of co-ordination between school and industry had been worked out. It was therefore decided to start the program as an *industrial-arts*, one-hour course, with the idea of determining its possible popularity among the students, its usefulness as a training program, and the possibilities for placement of graduates among the tradesmen and local employers.

Consequently equipment and supplies were sparingly added, and students who professed a desire "to learn something about electricity" were counseled into the program. Six one-hour classes per day, averaging 25 students per class, were arranged. From the beginning the course seemed to create interest. More equipment and supplies were purchased. The students themselves brought in additional apparatus and parts. Local employers contributed liberally and the shop grew. Finally, at the end of the first year, it was decided to enter the field of vocational training and to attempt to train for the electrical trade itself.

After making this decision, one of the first steps in organization was the creation of an advisory committee, made up of representatives of local employer, worker, and educational groups. This committee comprised nine men whose functions were to advise, among other things, on problems of student selection, training, and placement. Two or more meetings were held each year with results far outmatching our highest expectations. In the years that have followed the committee's help and advice have been invaluable in the smooth functioning of the class. Students are encouraged to seek individual advice from committee members. The instructor has many times sought help and guidance from committeemen, and various valuable personal contacts have been established in the close working student-instructor-employer relationship.

According to the present setup then, there are now three one-hour exploratory classes per day, from which students are selected for the three-hour "Smith-Hughes" trade training program.

A short time after the establishment of the trade training program a placement survey was made to determine the possibilities of local employment for graduate students. This was in 1939, at which time we were not yet in the war, but forward-looking leadership foresaw the need of training for helpers and apprentices in all trades and crafts. From the survey it was found that, while the immediate local need for electrical trainees was not great, the need in other communities was on the verge of rapid growth, and in the years to come that need would grow beyond our greatest capacity for training. This has, of course, occurred.

Since then the war has become a deciding factor in the control of curriculum construction. The San Bernardino Army Air Depot, now employing between 10,000 and 15,000 persons and located at the edge of town has taken many of our graduates. Their work in that area comprises commercial, light and power wiring, engine servicing, motor and generator maintenance and repair, aircraft wiring, electrical parts replacement and repair, instrument work, radio, etc. Other influences, such as the Kaiser Steel Plant at Fontana only a few miles away, the bomb loading plant in the north end of town, and other local as well as foreign activities and interests, have solved our placement problem and practically controlled the scopes, aims, and contents of our training programs.

In the past four years, the Smith-Hughes class has handled ten major commercial and power installations. These are all of school origin and were financed by the board of education. They include such projects as a new machine shop, new and old school buildings, nursery cottage, community canning factory, and others. All installations had to be inspected and passed by the city electrical engineer, and all were completely engineered and installed by the students themselves.

In the shop itself, such activities as motor rewinding, appliance repair, electrical testing, operation and control of electrical equipment, high frequency work, electronics, and many others are carried on.

FIG. 1

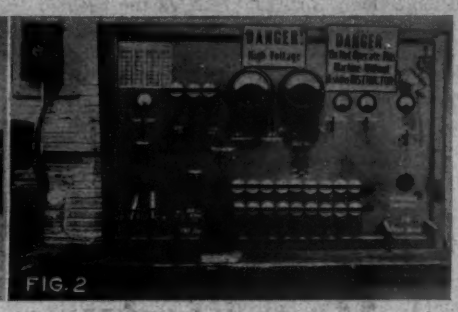


FIG. 2

(At left): Rewinding motors at clover-leaf bench. Note test camp on top of benches
(At right): Test switchboard for a.c. and d.c. electricity

FIG. 3

(At left): The welding booth
(At right): Corner of shop showing toolroom in background

*Senior High School, San Bernardino, Calif.

FIG. 5

FIG. 6

(At left): Appliance repair benches
(At right): Student turning a motor commutator

It has been found that this type of training prepares the student in the principles of electricity in such a way that he requires less training on specific jobs which he may secure after graduation.

As to equipment, there are certain unique features at San Bernardino High which may be considered in establishing any school shop. First, on account of the lack of space, it was found necessary to place the workbenches not in line, as is common practice, but in a four-leaf clover formation, as shown in Figure 1. This was not considered desirable at first, but it has proved to be quite advantageous in that it saves room, it removes that regimented atmosphere which is so resented by students, it facilitates group instruction by the teacher, it makes possible central test wiring to the benches and keeps down the original installation cost. It is recommended highly for these and other reasons.

Another shop feature is the utter absence of any side wall windows. All light comes from skylights, and all ventilation comes from the inside of the building and expulsion ventilators remove the used air through the ceiling. The result is a comfortably warm shop in winter and a surprisingly cool place to work in the hot summer months.

Shop tools of the power type include one 7½ k.w., 125 volt, d.c. generator driven by a 10 h.p., 3-phase, 220-volt induction motor. This set provides current for the two-test switchboards which employ both a.c. and d.c., and for the welding booth. See Figures 2 and 3. The entire set was salvaged from junk and was completely renovated by the students themselves. There is also a 3 h.p., 60-amp. battery charging M-G set, which is not only used for its original designed purpose but is also used for test and experiment. Another motor-generator set composed of a 15-h.p., 3-phase, 220-volt motor with speed step-up pulleys and shaft, and designed to drive a P-1 aircraft generator at 3000 r.p.m. is now in process of construction by the students. When completed it will make a fine welder and can be used for a multitude of instructional and useful purposes.

Machine tools include a 9-in. engine lathe, two drill presses, grinders, jointer, bench saw, vises, etc. — in all a completely equipped and extremely practical shop.

Commercial work is constantly provided for the students. Almost no pseudo work is done. All instruction has an actual practical value which prepares the student in the work he proposes to do in the future.

Postwar School-Building Heating and Ventilating

Samuel R. Lewis[1]

The pressure by government war agencies to conserve steel, copper, and nickel has brought out a long list of substitute materials for building construction and equipment. Ultimately many of these substitutes may be found to be better than the materials which had become conventional before the war. The failures, of course, will be dropped. To illustrate: it is probable that thin steel convectors, widely used in war plants in place of copper radiators and containing steam for heating air, will not endure, and that when the war plants eventually are wrecked, the buyers of many salvage items must be exceedingly "beware."

Great improvements have been made in building insulation which will save fuel, in partitions and walls with less thickness and weight without loss in efficiency, in corrosion-resisting tubing for fluids and gases, in electric conductors without rubber, and in wood products such as plywood and veneers. We have learned to manufacture and to employ cement-asbestos precast sheets or slabs to great advantage for ducts and air passages. Electronic devices for the control of heating, cooling, illumination, and power have developed amazingly. Plastic moldings and wall surfaces of great value in school-building construction have attracted most favorable attention.

Since few buildings which were under contract in 1941 have been finished, there has been no public school construction except for war-housing communities. Nearly all of the war-housing schools are of temporary type; many are heated by coal-burning warm air furnaces with pressure fans and nonmetallic ducts. No refrigeration for comfort-cooling purposes has been allowed since 1941.

War Pressures to Eliminate Ventilation

Where boilers were at all allowed in school buildings, pressure from the War Production Board has been toward the use of cast-iron sectional boilers. Fans and electric motors for ventilating purposes have been permitted in school buildings only under protest, and the volume of air allowed has been under constant attack by Washington zealots who expressed the belief that the designed new air volume per pupil per minute could be cut safely to as little as 5 cubic feet instead of the former minimum of 10 cubic feet, with air movement at a minimum of 30 cubic feet per minute.

They have suggested that odors which will accompany so small an air dilution can be removed by forcing the recirculated air through filters of activated carbon, such as were developed for wartime masks against poison gas. While such expedients may have a proper place in certain industrial processes, their universal application to school-building ventilation somehow does not awaken sympathetic endorsement.

Four Conventional Systems

Before 1942, a number of principal methods of heating and ventilating school-building classrooms were widely used.

1. The *all-blast system* transported the heat into the classroom on the air. There were no radiators in the rooms. The air was heated by direct-fired furnaces or by steam convectors exterior to the rooms. Ventilation volume was continuous, and temperature control was accomplished by varying the temperature of the air supply.

2. The *split system* included radiators placed in the classrooms. These radiators were essentially capable of warming the rooms without any help from the warmed air introduced for ventilation. The temperature

[1]Consulting Engineer, Chicago, Ill.

in each room was controlled by opening or closing the steam supply valves to these radiators.

3. The *unit system* involved an electrically driven fan and convector in each room, usually supplemented by more or less auxiliary direct radiation. The fan and convector takes in outside air directly through the wall, and was arranged to recirculate all or part of the air in the room. Generally there was no outside air supply whatever unless the room was too warm. Sales promotion for unit ventilation recommended using the corridors as passages for spent air.

4. The *all-blast system* necessitated the operation of the supply fan in order to heat the rooms. This system must be especially well designed in order to insure equal distribution of the warm air. Recirculation of the air prior to occupancy was possible so as to reduce fuel cost. Generally the all-blast steam system with continuous ventilation was most economical of fuel and served well for elementary schools.

The split system was excellently well adapted to manual training buildings and high schools where many departments were operated overtime or in the evenings, and where it was desirable to maintain comfort for a few instructors or pupils without operating large central air supply and exhaust fans.

The locally placed unit-ventilator system, when applied regardless of consequences to very large elementary schools, had definite failings in that the maintenance of a large number of small electric motors and of outside air-intake dampers was high and that two thermostats per room were costly.

The manufacturers recommended the entire elimination of any independent, local ventilating exhaust flues or ducts. They suggested an opening from each classroom into the corridor and openings from the top-story corridor ceiling into the attic. More conservative engineers condemned such a procedure because it invites smoke and heat, in case of fire, to fill the passages through which the pupils must escape. Since the thermostat on one of the walls cannot respond to variations in the temperature of the entering air, it is necessary to install an additional thermostat in the air stream leaving each ventilating machine, so that the entry of too cool air may be prevented.

Unit-ventilating machines in the ground level rooms of a school must have their outside air intakes so close to the ground as to pick up unnecessary dust and may even become clogged with snow. In one large school building the unit-ventilating machines were placed close to the ceiling in an attempt to overcome this objection, but the arrangement failed to maintain adequately warm floor temperature and satisfactorily cool head-level temperature. Despite these objections, the local ventilating unit is a cleverly designed and splendidly built device, especially useful for conservative school heating and ventilating services.

A Model Postwar System

If a board of education were to retain me to design the heating and ventilating of a new elementary school building, I think I should recommend some conservative innovations, but these would have basic characteristics with which I have had successful experience. The following high points would be included:

1. Steel boilers, two units, stoker equipped. Since most school buildings eventually require additions, I should provide space and chimney capacity for a third boiler. The efficiency of oil fuel used in locomotives for Diesel power so far surpasses the best that coal can do that no more oil should be burned in heating systems.

2. A central supply fan for classrooms, with a separate fan each for the auditorium and for the gymnasium. Exhaust fans for toilet rooms. Fans to be electrically driven.

3. An all-blast system; that is, the temperature of the air delivered to each classroom would be controlled by means of a double mixing damper responding to a thermostat in the respective room, the air delivery volume being continuous. There would be auxiliary-controlled radiant heat to compensate for downdrafts which come from large windows and exterior walls, but the radiant heat would not be designed to be sufficient in amount to permit occupancy without operating the supply fan. Offices and toilets rooms and auxiliary rooms would have independent heating.

4. Every classroom would have a vent flue leading to the attic, provided there with a no-back-draft damper and joining a trunk line duct in the attic. This duct would permit air recirculation back to the supply fan, or escape out of doors. The arrangement would allow 100 per cent recirculation while preparing the building for occupancy and would allow any desired percentage of new air from outside during occupancy. Without the automatic shutters in three-story buildings, the residual heat all gets to the top story while the fan is shut down overnight.

5. The admission of air into each classroom would be through six perforated ceiling panels in each room, delivering the air downward at relatively low velocity, with something like 60 square feet of distributed area. It would not be necessary to fur down the ceilings, since in most cases the joists are of concrete and the spaces between some of them can be utilized for air passages. This method of distribution reduces trouble from drafts, gives equal dilution to every zone, and indicates much less dust streaking than does sidewall air introduction.

6. The last place to economize is in the cleanliness of air, and so there would be provided near the supply fan inlet an electronic dust filter. This device arrests the smallest particles of every kind of dust, and may lessen materially the incidence of communicable diseases, as well as reducing maintenance of walls, floors, and ceilings.

7. The boilers, pipes, and heat transmitters would be full of water; not part water and part steam. This water would remain in circulation for indefinite periods, propelled throughout the system by an electric pump. It could be heated to steam temperature in very cold weather, but would be much less hot than steam in mild weather. There would be no traps, reducing valves, or air valves, and there would be no expense or labor for interior cleaning of the boiler heat-absorbing surfaces, since when using the same water, year after year, all mud and precipitable salts in the water would have been removed.

Such a system carefully adapted to the especial situation in each school building would, I am certain, provide maximum comfort, the hygienic well-being of the pupils, effective conditions for learning, and practical economy for the taxpayer, the community, and the school system.

Auto-Mechanics Department of the George A. Davis Vocational and Technical High School, Grand Rapids, Mich.

The Crusade for Color

John Sharpe Warren

The modern school should exemplify the best in interior decoration. A great deal has been written during the past few years concerning the use of color for interior decoration of school buildings, yet the use of color in our schools is not extensive. It has been found that color, properly used, can produce ideal conditions for learning. A few crusaders have begun to break the drab monotony of schoolrooms with color, and by so doing they have created an ideal psychological environment for the best results in learning.

Proper illumination is needed to make color schemes effective. The conventional color scheme of white ceiling, ivory upper wall, and light buff lower wall has served well in the educational development in America; it has led us to a better understanding of the importance of light in schoolrooms. There still is a place in modern school decoration for this color scheme, but the time has arrived for more useful, varied, and colorful schoolroom decoration; therefore let us join the crusade for color in the schoolrooms of America.

Special observations have been made of the use of color in the shops and office buildings in New York City. Broadway is a panorama of color; the colorful shops of Fifth Avenue cheerfully invite customers to enter and purchase colorful goods from all parts of the world. Radio City epitomizes modern skillful use of color. Businessmen find that color pays good dividends. Some hospitals have found that special attention to color is very beneficial to patients, especially those afflicted with nervous and mental disorders. School-board members as well as teachers and school administrators cannot afford to ignore the educational and psychological implications of color in interior school decorations.

Color and Color Schemes

Physicists have given us a better understanding of color through the study of light; but the action of pigments which we use does not wholly agree with the physics of color, probably due for the most part to impurities in the pigments. Psychologists have spent much time in experimenting with color preferences of children, men, and women with not too great success. Preferences for small areas of color — with which most of these experiments were concerned — do not correspond with preferences for large areas of color, like the schoolroom. For genuine color preference it is necessary to have the general impression of the whole scheme — floors, walls, ceilings, windows, and draperies — the *Gestalt* if you please. The interior decoration of the schoolroom is far more than its individual parts; it is a unity, a deliberate psychological environment which can be created and utilized for the best of educational results.

There are two general color schemes: color contrast and color harmony. Color contrasts, deftly executed, can produce splendid results, but it is believed that the best psychological environment can be produced by following color harmonies. By using color harmonies there is less likelihood of detracting from the whole purpose of the school, namely, that of being a pleasant environment in which learning may take place. Careful blending of colors can make the room appear spacious and friendly. The warm colors are generally accepted to be red, yellow, cream, and orange. These have a tendency to be cheerful and stimulating. By the same token greens and blues are accepted as the cool colors and tend to be relaxing or subduing. Reds and other pure hues should be used sparingly in the schoolroom. The shades may sometimes be used but it has been found that pastel tints are to be preferred. Well-chosen colors used with care can produce a delightful atmosphere for boys and girls as well as for their teachers.

The location and purpose of the room must be considered when planning decoration. Of the many color combinations to be found two are given here. Dr. H. H. Linn has been using the following painting scheme at Teachers College, Columbia University, for about three years:

Area	*Wall*	*Ceiling*	*Woodwork*	*Exposure*
Office	Gray-green	White	Gray-green	South
Office	Blue-green	White	Blue-green	West
Office	Sand-gray	White	Sand-gray	South
Office	Peach	White	Peach	South
Library	Green	White	Oak stain	South
Library	Cream	White	Oak stain	West
Classroom	Pale-yellow	White	Blue	North
Classroom	Flesh	Ivory	Gray-blue	West
Classroom	Ivory	White	Gray doors and windows; blue blackboard trim; coral picture molding	
Classroom	Outer wall cream; other walls turquoise blue	Ivory	Same as walls	West
Corridor	Salmon	White	Oak stain	South
Corridor	Peach	White	All wood same as walls, except doors which are cardinal red	

Dr. Linn's School Color Schemes

Musick's color schemes, designed to provide a solution to a variety of classroom situations are difficult to accept for they will generally produce classrooms that are too dark. It is of primary importance that the ceilings have high light reflective qualities. The following are Musick's color schemes:

Ceilings	*Walls*	*Dado*	*Woodwork*
Very pale green	Pale green	Grayed brown	Light oak
Ivory	Light tan or buff slightly grayed	Tan (slightly darker than walls)	Light oak
Ivory	Ivory to which has been added a small quantity of raw umber	Same except more raw umber	English oak

Musick's School Color Schemes

There are many other suggested color schemes, the great majority of them ranging between Linn's and Musick's. There are very few cases where the white ceiling is not the most desirable for practically all classrooms. The white ceiling is above the line of vision and certainly aids much in the illumination of the room. If colors must be used on ceilings adequate illumination should be provided.

The reflective value of colors must also be considered when planning the color scheme of the schoolroom. The following data, taken from the *Architectural Record* of April, 1935, agree very closely with other data found on this point.

Color	*Per cent*	*Color*	*Per cent*
White	84.0	Light gray	53.6
Cream	70.4	Light blue	45.5
Light pink	69.4	Sage green	41.0
Ivory	64.3	Aluminum gray	41.9
Yellow	60.5	Brown	23.6
Flesh	56.0	Dark red	14.4
Buff	55.4	Dark green	9.8
Light green	53.6	Dark blue	9.3
		Black	10.0

Reflective Color Values

To whom should we turn for guidance in the selection of color schemes? Acceptable schemes have been found which were worked out by the pupils and their teachers. Some suggest that the job is to be delegated exclusively to the professional interior decorator. A new and great field in interior decoration of schools is open to the professional decorator. Interior decorators who have specialized in home decoration have a tendency to produce work which is too dark and consequently not desirable for schoolrooms, and should be cautioned against it.

Color-Scheme Selection

Because it is believed to have inherent educational advantages this plan of color scheme selection is suggested: that the teachers discuss the color schemes with the pupils of their respective rooms, selecting those considered to be most adequate (this would have a most desirable educational effect); that small committees of teachers take the results, study and revise them; then, that a final committee for the school meet with the administrator and his staff officers to make the final selection; and finally, that they submit the results to a competent interior decorator who has specialized in school decoration. Of course, far less "fuss" will be made by simply letting the school administrator, his staff, the architect and the interior decorator do the work. But the students will be deprived of a wonderful educational experience, and a genuine interest in and appreciation for the final product will be lacking. However, it is necessary to remember that once the walls and floors have been painted it is expensive to make changes. Therefore it is not a bad plan to work out the color scheme in miniature, especially if radical departures are being made. Parents and other citizens of the community will approve of any scheme which makes for a happy and wholesome environment for the children.

Some decorators believe that color schemes of the corridors may be used as an inductive medium to the softer and more pleasing color schemes of the classrooms. Whatever attitude is taken about the decoration of corridors it must be remembered that they are a very important factor in the color scheme of the school. Visitors as well as pupils get their first impression of the school from the corridors. No effort should be spared in making them attractive and educational. Well-lighted and colorful display cabinets should be built into the walls. These display cabinets may be used for both educational and publicity purposes. A school can have no better publicity than that of exhibiting its good work.

Materials for Color Effects

There are many materials on the market for producing varied and desirable color schemes. Modern manufacturers can be depended upon to produce all the color desired in any materials, especially after the crusade for color gains more momentum. There is practically no need for semigloss and gloss oil paints in interior school decorations. The great variety of colors, and possible color combinations, of mat (or flat) oil paints should be in great demand. The casein paints are gaining favor because of their soft finish. The uses of calcimine are so few as far as the schools are concerned that nothing would be lost by eliminating it.

Plywood, knotted woods, maple floors, tile, tinted glass, glass bricks, linoleum with its many patterns and colors, and even washable wallpapers and other materials have their places in color schemes of schoolrooms. Some very fine results, for example, are being produced in tile where picture stories such as the Mother Goose Rhymes are used in kindergartens. The study of the many interesting materials is well worth one's time. Lack of color in schoolrooms certainly is not due to a lack of desirable materials. There are places in the school for murals and paintings, especially in corridors, cafeterias, gymnasiums, and auditoriums. These can be not only educative but also important in the general color scheme. Curtains and draperies, when well chosen, may aid much in producing desirable results. Venetian blinds may even be employed with good results. Nevertheless, draperies and curtains should never be allowed to impair the illumination in schoolrooms. After a room has been decorated in a color scheme it will often be found necessary to refinish picture frames, map cases, and other items in order that they may become a part of the color harmony of the room.

Generally, skilled workmen should be employed to do the decoration; however, there are cases where the children may not only do excellent work but may also gain lasting attitudes and appreciations. Kindergartens and lower grade children may be permitted to do a great deal of decoration, usually with water colors. The upper grade boys and girls can frequently produce superb results in murals, the plans for which are often of their own creation. There are many practical jobs which may be done by the boys in the vocational shops and the girls from the homemaking departments. Educators should use these opportunities for student participation in the interior decorating of the school, particularly when they promise lasting educational benefits.

Instructor Training for the Naval Air Technical Program

*Lieut. J. W. Giachino, U.S.N.R.**

The success of the American armed forces can be attributed to a great many factors. One thing is certain — our fighting men have been expertly trained. The expression "expertly trained" carries many implications. To those who are closely associated with technical training such a term most certainly implies that good instruction must have been provided. When we stop to consider the gigantic task accomplished since Pearl Harbor it seems almost miraculous that millions of men could have been trained to carry out a mechanized war in such a comparatively short period. Particularly is this true when it is realized that preparation for this war necessitated the training of so many technical experts. Nevertheless the job has been and is being done in a most effective and expeditious manner. Much of this success can be attributed to the excellent instruction given. The need for good instruction was recognized from the beginning and every effort has been made to provide it.

During the past three years a great deal has been learned about techniques of training. Due to the exigencies of war new and better methods of instruction have had to be developed. Not only has it been necessary to train men in countless fields where high degrees of skill have to be acquired, but it became necessary to train men to teach.

The purpose of this article is to sketch briefly the procedure instituted in the various training centers under the cognizance of the Naval Air Technical Training Command for training and upgrading instructor personnel. The Naval Air Technical Training Command, headed by Rear Admiral H. S. Kendall, is responsible for directing all technical training except flight instruction. This training represents an extensive field in aviation technical trades, all of which require skillfully trained men. Although men under instruction in this program primarily are trained to perform the duties of their specialty as required by naval forces ashore and afloat, nevertheless they are getting training in basic skills that are common to numerous civilian occupations. Actually thousands of men are receiving a type of technical background that ordinarily could not have been obtained as civilians. As a result, these men will be in a position to secure better civilian jobs as well as to readjust themselves in new occupations more quickly. In discharging its responsibility of giving the men the best possible training that is broad in scope and still has some degree of specialization, headquarters initiated an instructor training program to provide (1) a constant supply of adequately trained instructors and (2) means to upgrade instructors and supervisors professionally and technically.

Nature of Instructor Training Program. Since time was short, it became apparent that standard practices in training teachers could not be followed. A plan had to be developed that would produce competent

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Techniques of teaching and giving demonstrations — Official U. S. Navy Photograph

instructors in the limited time available. Moreover, because a large percentage of the men selected as instructors had limited educational background, it was mandatory to devise an instructor training program that would be practical in its entire scope and would not necessarily hamper a man's progress because he lacked certain educational qualifications. Consequently the plan had to be simple but thorough enough to embrace all the basic principles of educational practices that have withstood the test of experience in schools and universities as well as in employee training within industry. In employing these basic principles it was necessary to streamline them so that the average student could quickly comprehend their significance and readily apply them in his teaching.

Another requisite of the plan was to provide means whereby prospective instructors would be indoctrinated in the techniques of impelling students to improvise. This was essential, inasmuch as in all technical training programs opportunities are presented so men can learn to carry out specific jobs under adverse conditions. For example, after a trainee is taught the correct procedure in repairing a bullet hole or crack in the hull of a flying boat, conditions are simulated so that he must perform this repair without the proper tools or materials. In accomplishing this work, instructors are trained to use guiding techniques that will stimulate students to use their skills and knowledges to perform work requiring improvisation.

Another factor that was needed for a practical instructor training program was some form of refresher training to encourage technical and professional growth. Otherwise the nature of instructional duty is such that instructors often tend to stagnate because of a lack of mental stimulation which inevitably leads to ineffective teaching. Finally, the program had to consist of a number of integrated phases of practical performance type of instruction and not merely a series of isolated paper-work courses encompassed with a mass of words that might be nice to know but did not necessarily contribute to the acquisition of teaching skill.

The instructor training plan that finally was developed and incorporated in all training centers consists of three parts:

1. Preservice (training of new instructors)
2. Training of instructional supervisors
3. In-Service (upgrading of instructors in service)

Phase I — Preservice

The purpose of this phase of the program is to indoctrinate the selected instructor candidates to the basic principles of teaching techniques. This course covers a total of 96 hours and is divided into three parts:

Part I — Basic teaching techniques ..... 48 hours
Part II — Observation and analysis of class and shop activities..... 24 hours
Part III — Additional technical training ..... 24 hours

Part I of the course is devoted to discussions of the principles of good teaching and actual participation by the students in preparing lesson plans, putting on shop demonstrations, conducting classroom discussions, etc. The whole theme of the course is "learning by doing." The principles and techniques of teaching are mastered by practical application. Instruction is mainly centered on the following 11 units:

Unit I. The instructor

— Official U. S. Navy Photograph

Learning how to use a projector

Unit II. How the student learns
Unit III. How to use the discussion method in teaching
Unit IV. How to teach by the demonstration method

Unit V. How to use instructional aids in teaching
Unit VI. How to plan a lesson
Unit VII. How to present a lesson
Unit VIII. How to make and use tests
Unit IX. How to interpret tests

instructor under some leading instructor in the activity he has been trained to teach. When in the judgment of the leading instructor and supervisor he is considered competent to handle a class he is then given a full teaching assignment.

16. Interrelationship within the training program
17. Selection, in-service training, and placement of instructors
18. Rating instructors
19. Evaluating instruction and supervision

OBSERVATION CHECK SHEET NO. 1

.... (Name of Demonstrator) (Type of Demonstration)

..... (Observer)

Directions: Circle one of the five numbers following the item to indicate your rating of the instructor on this item. No. 1 will be the lowest rating and No. 5 will be the highest. Add notes to clarify your observation or to make suggestions in the space provided.

	Low		*Average*		*High*
1. Were materials, tools, instructional aids, etc., at hand?	1	2	3	4	5
2. Could students see and hear clearly?	1	2	3	4	5
3. Were objectives explained?	1	2	3	4	5
4. Was tie-up made with previous and future lessons?	1	2	3	4	5
5. Were important points to look for brought to students' attention before demonstration was given?	1	2	3	4	5
6. Were new terms and parts explained?	1	2	3	4	5
7. Did the instructor talk to students rather than to parts or walls?	1	2	3	4	5
8. Were operations performed at correct pace for clear understanding?	1	2	3	4	5
9. Were operations, performed skillfully, in proper sequence, and according to approved procedures?	1	2	3	4	5
10. Were students encouraged to ask questions during the demonstration?	1	2	3	4	5
11. Was progress of group held up unnecessarily with explanations to individuals?	1	2	3	4	5
12. Were questions asked during the demonstration to test understanding?	1	2	3	4	5
13. Did any trainees participate in the demonstration?	1	2	3	4	5
14. Was safety stressed?	1	2	3	4	5
15. Was summary made?	1	2	3	4	5
16. Was interest and attention maintained throughout the demonstration?	1	2	3	4	5
17. Was it of correct length to do the job?	1	2	3	4	5
18. Could supplemental aids be added to improve the demonstration?	1	2	3	4	5
19. Was location suitable for best demonstration?	1	2	3	4	5

Recommendations:

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Sample Demonstration Check Sheet

Unit X. How to conduct shop activities
Unit XI. Line operational teaching

Part II of the course gives students an opportunity to check good teaching techniques and shop management. The men are divided into groups and sent out to observe outstanding instructors in various departments. Immediately upon returning from these observations an analysis is made of the type of teaching seen. To give students some basis by which to evaluate instruction during observation periods, they are provided with check sheets (see sample) as guides in recording their findings.

Part III of the course permits the prospective instructor to go back into the shop and classroom and acquire additional knowledge and mechanical skill in the subject he is expected to teach. Thus, for example, if a student is being trained to become a welding instructor, each day for a two-hour period during the course he returns to the shop and actually performs all the jobs which are to be used in teaching the required welding operations. In addition to giving the prospective instructor an opportunity to acquire higher degrees of skill, this part of the course enables him to study each job and operation in terms of the role he is to play when he becomes an instructor.

At the end of the preservice course the student is assigned to serve as assistant

Phase II — The Training of Instructional Supervisors

The function of this phase of the program is to familiarize selected supervisors with their duties and train them to effectively carry out their responsibilities. This phase of the program consists of the following two parts:

Part I — General practices in supervision of instruction
Part II — Technical refresher training

Part I of the course comprises a series of regularly scheduled conferences. Discussion is centered on a review of good teaching practices and supervisory techniques. The following topics are covered:

1. Introduction of supervision
2. Duties and responsibilities of a supervisor
3. Human relations
4. The instructor
5. How the student learns
6. How to use the discussion method in teaching
7. How to teach by the demonstration method
8. How to use instructional aids in teaching
9. How to plan a lesson
10. How to present a lesson
11. How to make and use tests
12. How to interpret test scores
13. How to conduct shop activities
14. Operational teaching
15. Principles of shop and classroom management
20. Conducting instructor's meetings
21. Preparing and executing a supervisory plan
22. Keeping instruction up to date
23. Planning ahead

Along with the discussion of the listed topics the specific duties of each supervisor are outlined and instruction is given as to how they are to be carried out. A general indication as to the nature of a supervisor's duties is listed below:

1. *Supervisor of instruction as an instructor*

a) Securing information concerning the work of the phase and its relation to other phases.

b) Preparing a plan for supervision.

c) Preparing recommendations for the phase.

d) Preparing standards and recommendations relating to the teaching staff.

e) Preparing and supervising a program for the improvement of instructors in service.

f) Assisting in the development of courses, instructional material, and training aids.

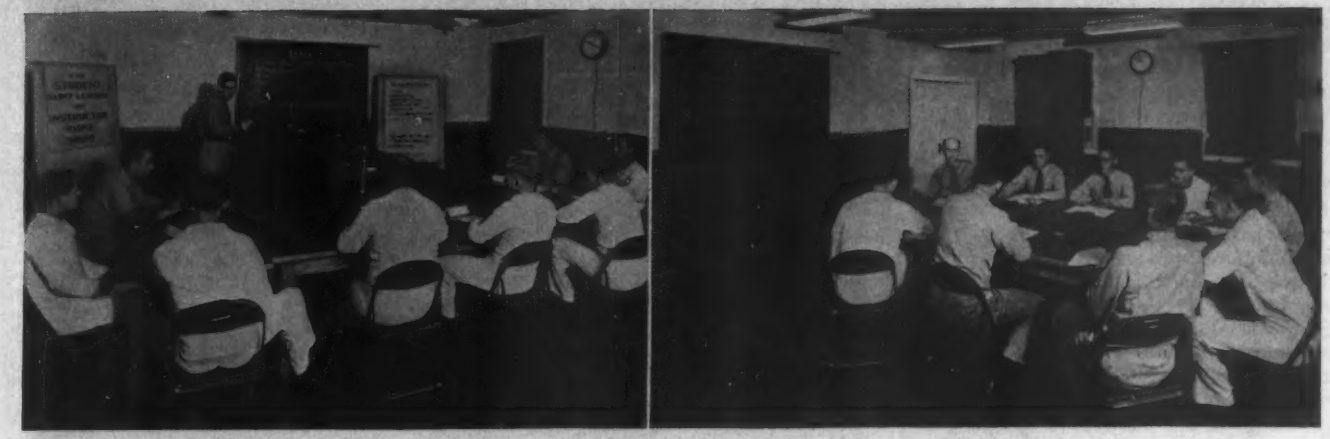
g) Making job analyses and cooperating with instructors in the preparation of lesson outlines, bulletins, and text material.

h) Cooperating with instructors in the measurement of the value of the instruction.

i) Conducting experimental work on problems related to the supervisory field.

j) Keeping informed about new developments in the technical field being supervised.

2. *Supervisor of instruction as a manager*



Developing lessons and discussing duties — Official U. S. Navy Photograph

a) Preparing instruction working schedule.

b) Preparing reports with recommendations setting forth the needs of the phase with reference to rooms, new equipment, etc.

c) Supervising installations of new equipment and providing for its maintenance and care.

d) Preparing specifications and requisitions for supplies and equipment and providing for their efficient use.

e) Promoting an effective morale on the part of the instructors and staff.

f) Providing instructors with suitable forms and guides for reporting the work of the class.

g) Preparing and submitting reports.

h) Keeping informed about new developments.

i) Maintaining proper working conditions.

j) Establishing and maintaining safety practices.

k) Establishing procedures for maintaining the physical plant in first-class condition.

l) Providing efficient use of all instructional equipment.

m) Maintaining efficient use and care of supplies, tools, and equipment.

3. *Supervisor of instruction as a military leader*

a) Maintaining the proper respect for military authority.

b) Maintaining discipline.

c) Enforcing station rules and regulations.

d) Promoting the work of the phase to make it more effective when the students enter combat duty.

e) Promoting an effective morale on the part of the instructors and staff.

Part II of the course consists of a program of technical upgrading to insure that all supervisors are constantly up to date in their respective fields. Technical upgrading is achieved by any one or more of the following means:

a) Visitation and observation in operating squadrons.

b) Rotation of supervisory assignments within the respective schools.

c) Visitation, or temporary duty under instruction in short courses at advanced training center.

d) Visitation, or temporary duty under instruction at factories.

e) Visitation, or temporary duty for observation at various training centers of this command.

f) Attendance at advanced technical courses of short duration within the various departments of the school to which the supervisor is attached.

Phase III — In-Service Program

The In-Service program is designed to upgrade all regular instructors, particularly beginners.

Experienced supervisors, as well as instructor trainers, are required to visit regularly the classrooms and shops of a particular phase of training and observe the teaching. At some convenient period the supervisor, instructor trainer, or both, meet with the instructors observed, either individually or in a group and discuss with them whatever discrepancies that may have been evident.

In addition, scheduled meetings are held to discuss certain techniques of teaching and shop management with all instructors or those teaching the same course.

To insure that instructors are constantly up to date in technical knowledge and at the same time provide them with means of improving their mechanical skills, arrangements are made to have them attend advance courses specifically provided for them in the training center. In some instances certain key instructors are sent to other centers or factories to obtain instruction on some current piece of equipment. Upon returning these men serve as leaders in conducting conferences or classes to pass on the new information to other instructors.

Instructor Training Procedure. Most of the training and upgrading of instructors and supervisors is conducted by officers having had considerable civilian experience in shop training. In some instances certain phases of the program are handled by qualified enlisted personnel under the direction of some officer.

One factor that is adhered to consistently is holding the size of groups under instruction to a maximum of ten. This has provided latitude in rendering individual instruction and assistance to correct some personal defect such as speech, mannerisms, appearance, and the like.

As mentioned previously, prospective instructors learn to teach by teaching. Thus, for example, the men are required to plan and put on shop demonstrations and classroom lessons until they have mastered the proper techniques of presentation. They learn the art of using instructional aids in getting across their lesson. Since instructional aids are employed extensively in all Naval Air Technical training, considerable time is devoted in teaching the men how to handle such aids as movies, slide films, mock ups, models, charts, information sheets, job plans, and the like.

The discussion of the "how, why, where, and when" of teaching principles is conducted for the most part by the conference method. Every effort is made to avoid as much as possible the usual stereotyped lecture when discussing these techniques of teaching. By shunning the so-called typical classroom atmosphere the interest of the men is held more intently and greater enthusiasm is displayed to master the skills of teaching.

Another practice that is closely followed is never to present abstract principles of learning, psychology, etc. It is true that a good teacher must possess a basic foundation of the principles of learning and psychology. However, such aspects of these principles that are necessary and contribute to the individual's knowledge are carefully woven into practice teaching situations so that the men can readily see these principles in operation. This definitely gives them an opportunity to study the significance of the principles by means of application. For example, the principle of readiness in learning is observed by setting up a teaching situation that brings out the fact that learning takes place only when a student can be made to see a need for

it and has been properly primed to receive the instruction. In other words, by giving the men an opportunity to see principles in action rather than attempting to explain them, the whole technique of turning out teachers is greatly simplified.

Selection of Instructor and Supervisory Personnel. The rapid expansion of the training program made it necessary to secure instructor and supervisory personnel in large numbers. Although some of these men had civilian experience in teaching, in general this group was comparatively small. Consequently the only recourse was to use enlisted personnel for instructor billets who possessed technical experience. Naturally, it was realized that knowledge of the subject does not necessarily qualify one as a good teacher; that training, to be effective, must have teachers who know how to teach.

Considerable attention is given to the selection of candidates for instructor training inasmuch as not all people are temperamentally suited for instructional duties. Moreover, since one of the most important ingredients of a good teacher is a high level of morale, only qualified men who have a desire to teach are selected.

Instructor personnel for Naval Air Technical Training activities is secured from two sources: (1) retained graduates of the school and (2) men returned from the fleet. The retained graduate is selected on the basis of the following six factors:

1. Mastery of subject matter and civilian technical experience
2. Maturity
3. Ability to express himself properly
4. Ability to handle men and work with others
5. Desire to teach
6. General appearance

Students showing indications that they possess these characteristics are tagged and close check is kept on them as they go through their technical training. Some time before graduation these men are called before an interviewing committee for a final scrutiny and if found satisfactory they are assigned to the instructor training course.

Men returned from the fleet also are required to possess the qualifying standards before being assigned to instructor training.

Supervisors, as a general rule, are chosen from the teaching staff who have displayed unusual talent as instructors. Some are selected because of their exceptional naval technical background. Practically all of these men are chief petty officers whose rank distinguishes them as individuals possessing high technical skill and ability to handle men. Having been selected as supervisors such men are then indoctrinated in the duties and techniques of supervision by attending the supervisory training program.

Instructor Training Literature. Inasmuch as most of the available teacher training literature was not readily adaptable for the accelerated program initiated by the Naval Air Technical Training Command, it became necessary to prepare new publications. Accordingly a basic text on principles of teaching techniques was planned and published. The material written was kept on a level that could be understood easily by the student. Furthermore, only such information was included as was actually usable by the prospective instructor.

For the supervisory training program a series of bulletins was prepared outlining the various supervisory topics. These bulletins generally are presented to supervisors before their scheduled meetings to give them an opportunity to become familiar with the topic so that they can think the matter over and thus be able to participate in the conference.

Conclusion

The program of instructor training in use at Naval Air Technical Training Centers undoubtedly has many limitations. However, since time was so short and a need for trained men so urgent some inconsistencies were bound to occur regardless of the nature of any plan. Nevertheless the present program is accomplishing its mission. If the techniques being used to train instructors as well as students are producing good results then possibly vocational industrial education should make some attempt to appraise them. The results may be such as to influence the future trend of the training given in vocational schools.

Instructor Training for the Amphibious Forces

*Lt. (jg) Homer C. Rose, U.S.N.R.**
*Lt. (jg) John H. Wagner, U.S.N.R.***
*Lt. (jg.) Michael B. Callahan, U.S.N.R.****

The story of how instructors are trained for the Amphibious Forces, Atlantic Fleet, is best told by reviewing the experience of one of the men.

Before he put on a navy uniform, George was a mechanic in a garage. He was ambitious, intelligent, and proud of his technical knowledge and ability to use the tools of his trade, but he did not teach or train others.

In fact, the word teacher reminded him of a thin, tired woman talking before a class of unruly youngsters.

George left the garage to join the navy and now, after training in "boot" camp, a navy school for mechanics, and a year's operating experience in the Pacific, he finds that the Personnel Department has assigned him as an instructor. He is sent to the Engineering Department to teach classes in the care and operation of diesel engines.

By the end of the first day George has gained a great deal of experience but his spirits have reached a new low. Students did not seem interested — he had to speak to several to keep them awake. His throat is dry and tired from talking. He realizes that his material has no logical organization. He feels as though he has told the men all he knows in the first period; yet he wonders how much they will remember for the weekly examination and for the real test to come weeks later afloat.

For the first time George begins to appreciate the skill and confidence he has seen in some of his best teachers. Being intelligent and ambitious, George decides that perhaps there are some definite principles and techniques in teaching just as there are in the job of keeping the ship's engines in operation. George is ready for some training as an instructor.

He has been told that all new instructors received training as teachers in special classes. He was more pleased than surprised a short time later when he was ordered to report to Instructor Training to take the course.

A very natural curiosity prompted George to ask what the course contained and the instructor training officer described it as follows:

During the ten hours of instruction there would be material of a practical nature given on the basic techniques of teaching. The lessons would be scheduled thus:

Lesson 1. An overview of teaching as a skill. In this lesson the objective and nature of the course are explained and a film is shown to emphasize the need of training for teachers.

Lesson 2. Basic ideas about learning.

*Director, Instructor Training Program, Amphibious Training Command, Norfolk, Va.
**Instructor Training Officer, Amphibious Training Base, Ft. Pierce, Fla.
***Instructor Training Officer, Little Creek, Va.

Fig. 1. Student instructors making lesson plans in the instructor-training class. Each plan is carefully checked by the instructor as the plan is written. Plans are also read and approved by the officer-in-charge of each department before they are used

This lesson is designed to give the student instructor some of the principles of learning as they apply to a typical navy class. Specific problems such as motivation are analyzed in the light of the basic principles.

Lesson 3. Techniques for giving a demonstration. This is the method of instruction most common to the school; therefore the technique is carefully worked out and emphasized by means of a sample demonstration by the instructor training officer, and a film on how to give a demonstration also is shown. A controlled discussion follows to bring out the main points.

Lesson 4. Questioning and tips on speaking. A few of the more basic ideas on how to speak are discussed and demonstrated. Special attention is given to the use of questions in teaching.

Lesson 5. Analysis of subject content for a lesson. In this lesson each student analyzes a unit of instruction that he is preparing to teach. Organization, content, and key points are considered.

Lesson 6. Planning instruction. This lesson is designed to give the student instructor an opportunity to plan all of the teacher-student activity for a lesson he may teach. The resulting plan will incorporate all of the ideas on teaching from the previous lessons.

Lesson 7. Practice lessons. Each student instructor presents part of a lesson as he would to his own classes. A recording is made of his voice and his lesson is analyzed for strong and weak points by the class.

Lesson 8. Teaching problems. This lesson is conducted by the discussion method in an attempt to give students a concept

"BAWLING OUT"
1. WILL DISCOURAGE A MAN from TRYING
2. WILL LEAVE A MAN SORE
3. IS DONE IN ANGER
4. IS DONE IN PRESENCE OF OTHERS
5. IS DONE WITHOUT CHECKING FACTS
6. IS USUALLY UNJUST
BAWLING OUT Never WORKS

Fig. 2. Visual aids such as this are used to stimulate learning in the instructor-training course

of how to solve their teaching problems as they come up in all classes.

Lesson 9. Testing. Basic ideas on testing are explained and types of tests are studied.

Lesson 10. Summary test discussion. The lessons vary in length in relation to their importance and the progress of the group. Officer classes also include a lesson on supervision since many of the officers have some responsibility, as senior instructors.

George found the course very much different from some other courses he had taken. He had many opportunities to express his ideas and to ask questions. There were no long lectures and each lesson seemed to hit the bull's eye of specific problems. Obviously, the course had been especially designed for the needs of the "Amphibious" instructors. He found that the psychology of teaching was just good common sense and that he had to think and plan ahead as he had done in operating the ship's engines.

One novel device was of particular interest to the entire class. The machine is called a "Magnetic Wire Recorder and Reproducer." By means of the equipment each student had part of his practice lesson recorded and reproduced. Remarks and criticisms were held on a friendly plane so that the experience with the recorder was enjoyable as well as profitable.

Members of the class looked forward to having a recording made on their regular teaching situation. Since the recorder is available at all times a teacher can request it whenever he has a particular lesson that he wants recorded.

George decided that he would like to hear a recording of the lesson he had planned in the instructor training class. He had put his best efforts into the plan. Provision had been made for student participation, the subject was analyzed so that key points could be emphasized and stimulating questions had been written out to cover all the main points of the lesson.

A schedule was worked out with the instructor training officer for the use of the recorder. During the lesson George had the feeling that he was master of the situation. Since he had made thorough preparation and had anticipated all that should take place in the class period, he had no real fear of failure. He knew that the instructor trainer would weigh the various elements in his lesson and would be fair and helpful in the conference that was to follow.

Soon after the lesson he reported to the instructor training office with his lesson plan. The lesson was reproduced with the recorder. At the same time he and the instructor trainer followed the written outline of the lesson. Every few minutes the recorder was stopped and points of technique or methods were discussed and notes made on the lesson plan. This reminded George of his technique for tune up and adjustment on an engine. The instructor trainer was able to provide several ideas to be used in presenting the lesson and George left with a feeling of accomplishment, and with the knowledge that the instructor training department would help him in any teaching problem.

George is not unique by any means. There are thousands of instructors in the navy who have been selected for their billets primarily on the basis of a knowledge of some skill.

The navy recognizes that a skilled workman is not necessarily a competent teacher and that the need for trained men is too

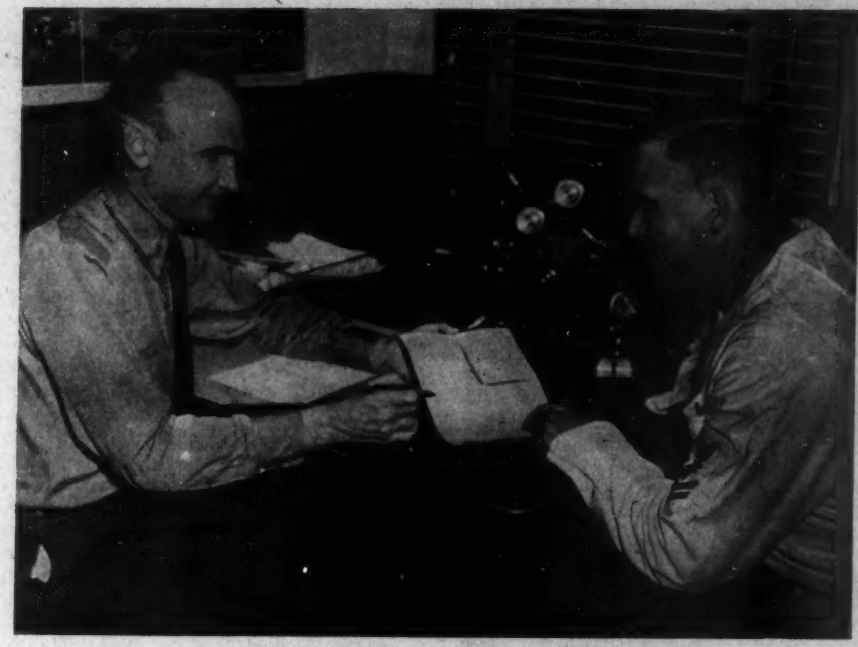


Fig. 3. Instructor trainer and instructor listen to a recording of a lesson. The lesson plan used by the instructor in teaching the lesson is checked with the recording and ways of improving the plan are noted

pressing to use any apprenticeship method of training.

The answer has been sought in the institution of an instructor training program, which was applied to Amphibious Training Command, Atlantic Fleet, in June, 1944. Officers, qualified by training and experience to train vocational teachers were assigned to each of the amphibious training bases. One additional officer became the co-ordinator of the program.

Instructors in the schools are trained by classroom instruction, by personal follow-up and in-service training.

A short course in methods of teaching is given to all instructors, both officers and men, as soon as possible after they report for duty. The major objectives of this course are:

1. To orient the new instructor in the field of vocational teaching.

a) To develop attitudes and appreciations which will cause him to become conscious of his importance as a teacher.

2. To indoctrinate instructors in their jobs:

a) To gain a background or understanding which will enable them to develop teaching skill.

b) To develop a measure of skill in the use of specific teaching techniques.

Main topics of subject matter included in the course:

1. The student, the teacher, the principles of learning.
2. How to plan instruction.
3. Analysis of the skills involved in jobs to be taught.
4. The demonstration method of teaching.
5. Evaluating instruction.

The classes are conducted as directed conferences, in which the instructor offers some information upon which to build a discussion, stimulate the asking of questions by the group, and solves the problems brought up only when a solution is not forthcoming from the group. Short tests are used to cover the main points of discussion and their application to specific situations. *Wire recordings* are made of short lessons by the students in the class. These are played back and analyzed by the students in the class with the help of the instructor.

The second portion of the instructor training program consists of in-service training which is made up of classroom visitations and conferences with instructors, together with the dissemination of further instructional material.

Through contacts with senior instructors of the various schools, those teachers who are in need of assistance are found and visited.

After watching the classroom performance of the teacher, the instructor trainer immediately calls to his attention the strengths and weaknesses of the instruction. Every effort is made at this time to impress the new instructor with the idea that the aim of this conference is to help him to do his job more easily. All criticism is given in the spirit of helpfulness.

This informal conference is followed up by a more formal rating which takes the form of the instructor evaluation sheet shown in Figure 4. This evaluation sheet is prepared in triplicate. The original is sent to the training officer in charge of schools, the second copy goes to the senior instructor and the instructor observed. The third copy is filed by the instructor training department for future reference.

It has been found that, by this means, several of the objectives of the program can be met.

Primarily, personal follow-up is a way of doing coaching on the application of the general principles and techniques taught in the basic 10-lesson course. By observing which items the new instructor has failed to grasp or apply, it becomes a fairly simple task for the instructor trainer to direct the teachers' energies toward remedial steps.

It is a rare individual who doesn't get a spiritual "lift" when someone observes his work and, while commenting critically on it, makes an honest effort to be of assistance in making the job easier or better.

Observation ___
Trend ___

INSTRUCTION EVALUATION SHEET

Instructor ___ Rate ___ Date ___

Lesson title ___

Department ___ No. in class ___ Period ___

		A	B	C	Y
Physical Aspects of the classroom	Light, heat, ventilation				
	Student arrangement				
	Distractions				
Physical Aspects of the instructor	Voice				
	Appearance				
	Poise, tact, mannerisms				
Did the instructor (1) Follow a lesson plan?					
(2) Have visual aids and materials ready for use?					
(3) Introduce the lesson adequately?					
(4) Have adequate preparation made to teach the lesson?					
(5) Use step-by-step presentation and proper emphasis?					
(6) Make use of summaries and effective repetition?					
(7) Relate material to past experience of learners?					
(8) Emphasize key points in the lesson?					
(9) Make use of questions during the lesson?					
(10) Use student participation and drill?					
(11) Summarize the lesson taught?					
(12) Show confidence and authority?					
(13) Show enthusiasm and keep interest of the class?					
(14) Maintain good discipline?					

Summary Grade ___ Total ___

COMMENTS: ___

RECOMMENDATIONS MADE TO: Instructor ( ) Dept. Head ( ) Training School ( )

1. ___
2. ___
3. ___
4. ___

Observer

Observation 1
Trend (C.C.B.)

INSTRUCTION EVALUATION SHEET

Instructor DOE, John Rate Bkn. Date 11 Dec. 44

Lesson title Methods of Obtaining Materials

Department C. and B. No. in class 18 Period 3rd

		A	B	C	Y
Physical Aspects of the Classroom	Light, heat, ventilation		X		
	Student arrangement		X		
	Distractions		X		
Physical Aspects of the Instructor	Voice			X	
	Appearance		X		
	Poise, tact, mannerisms		X		
Did the instructor (1) Follow a lesson plan?		X			
(2) Have visual aids and materials ready for use?			X		
(3) Introduce the lesson adequately?			X		
(4) Have adequate preparation made to teach the lesson?			X		
(5) Use step-by-step presentation and proper emphasis?			X		
(6) Make use of summaries and effective repetition?			X		
(7) Relate material to past experience of learners?			X		
(8) Emphasize key points in the lesson?			X		
(9) Make use of questions during the lesson?				X	
(10) Use student participation and drill?			X		
(11) Summarize the lesson taught?			X		
(12) Show confidence and authority?		X			
(13) Show enthusiasm and keep interest of the class?			X		
(14) Maintain good discipline?			X		

Summary Grade B Total 3 1 0 2

COMMENTS: Instructor taught PBO officer class methods to be used in obtaining materials aboard an LCM. We gave each student a C. and B. manual and this was used as a reference from time to time. This instructor has a tendency to talk in a monotone voice. He followed a well organized lesson plan.

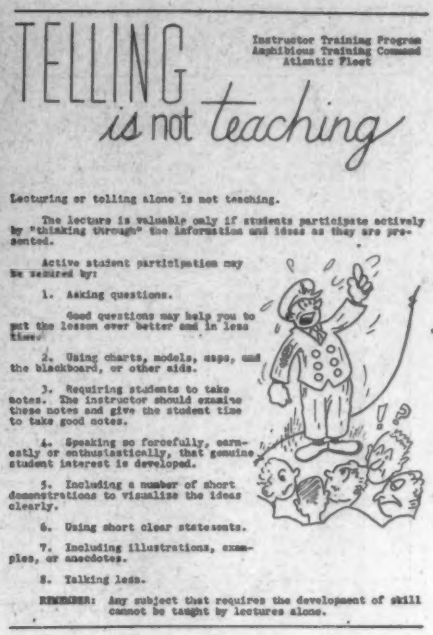
RECOMMENDATIONS MADE TO: Instructor (X) Dept. Head ( ) Training School ( )

1. Vary voice. Make lesson as practical as possible.
2. Improve questioning procedure.
3. Suggest introduce chart sooner in this lesson and secure another.
4. chart for material not covered (as per our conversation at end of class).

(Signed) Joseph Smith
Observer
Lt. (jg) Joseph Smith

Fig. 4. Rating sheet, also rating sheet filled out by observer. Copies of the rating sheet are sent to officer in charge of schools, to the instructor training department, and to the instructor observed

Fig. 5. Instructor, instructor training officer, and officer in charge of schools (reading from left to right) talk over plans for improving instruction. The instructor trainer acts as an educational specialist and advisor to the officer in charge of schools



TELLING *is not teaching*

Instructor Training Program
Amphibious Training Command
Atlantic Fleet

Lecturing or telling alone is not teaching.

The lecture is valuable only if students participate actively by "thinking through" the information and ideas as they are presented.

Active student participation may be secured by:

1. Asking questions.

Good questions may help you to put the lesson over better and in less time.

2. Using charts, models, maps, and the blackboard, or other aids.

3. Requiring students to take notes. The instructor should examine these notes and give the student time to take good notes.

4. Speaking so forcefully, earnestly or enthusiastically, that genuine student interest is developed.

5. Including a number of short demonstrations to visualize the ideas clearly.

6. Using short clear statements.

7. Including illustrations, examples, or anecdotes.

8. Talking less.

REMEMBER: Any subject that requires the development of skill cannot be taught by lectures alone.

Fig. 6. Another visual aid used

This motivation by personal contact is another major objective of the visitation program.

A third objective, that of checking the effectiveness of the basic ten lesson course, is met by noting comparisons between evaluations of instructors before and after having had the course.

When, upon compilation, the evaluation sheets show general weaknesses in certain aspects of classroom techniques, two things are done. First, greater emphasis is put on those items in the basic course. Secondly, a less personal type of follow-up is used.

The second method of in-service training is the distribution of information sheets, like the one shown in Figure 6, to all instructors. The use of this type of sheet by the schools and instructors within the schools is based on a wholehearted, active cooperation and upon the honest desire on the part of all concerned to make the training as good as it can be made.

A large proportion of the success of instructor training is dependent upon the attitude of the naval officers in charge of training programs. In this connection it must be said that every responsible officer has been fully aware of the problems involved and the magnitude of the task of making qualified instructors of officers and men who, although experts in their field, have had little or no experience in vocational teaching.

Check Sheets and Rating Scales for Lessons and Conferences

*H. W. Paine**

Teacher-Training Methods Classes

In the area of vocational teacher improvement, especially for the trades and industries, the various teacher-training agencies offer numerous courses such as "Methods of Teaching Occupational Subjects," "Techniques for Beginning Teachers," "Practice Teaching," and "The Conference Method of Teaching." The chief objective of these courses is to improve the teaching and conference leading techniques of the employed vocational teachers and pre-employment groups by acquainting them with accepted teaching methods and conference leading procedures. In all of these courses it is customary for the various members of the classes to offer sample lesson units or sample conferences for criticisms and suggestions for improvement from the other members of the classes. It is obvious that the more logical and objective the ratings of the

SUGGESTIVE LESSON-PROCEDURE RATING CHART

(For Rating the Allen Four-Step Lesson Procedure)

STEPS	100 A=4 93 Checking Points For EXCELLENT LESSON	92 B=3 85 Checking Points For GOOD LESSON	84 C=2 77 Checking Points For FAIR LESSON	76 D=1 70 Checking Points For POOR LESSON	69 F=0 0 Checking Points For FAILURE LESSON
PREPARATION STEP I	1-Excellent introduction of topic 2-Thorough check of background of student 3-High interest aroused in student 4-Excellent focus on J.O.P.	1-Topic introduced well 2-Good check on background of student 3-Good interest aroused 4-Good focus on J.O.P.	1-Topic fairly well introduced 2-Some check on student's background 3-Fair interest aroused 4-Some focus on J.O.P.	1-Little or no introduction 2-Little or no check on student's background 3-Little interest 4-Focus on J.O.P. weak	1-No introduction given 2-No check of student's background 3-No interest aroused 4-No focus attained
PRESENTATION STEP II	1-Clear explanation 2-Proper emphasis on important points 3-Thorough demonstration and excellent thought-questions used. Great student participation attained 4-Excellent illustrations and teaching aids 5-Complete provision made for individual differences in assignments	1-Good explanation 2-Some emphasis on important points 3-Good demonstrations, good thought-questions used and much student participation attained 4-Good illustrations with some teaching aids 5-Quite adequate provisions made for individual differences in assignments	1-Fair explanation 2-A few points emphasized 3-Fair demonstration, fact questions, a few thought-questions and some student participation 4-Fair illustrations, a few teaching aids 5-Some provisions made for individual differences in assignments	1-Poor explanation 2-An occasional point emphasized 3-Poor demonstration, lack of preparation, some errors in procedure, poor thought-questions and little student participation 4-Very few illustrations or teaching aids 5-Inadequate provisions made for individual differences in assignments	1-Explanations failed 2-No emphasis on important parts 3-Demonstration lacking, or unorganized and full of errors, no thought-questions and no student participation 4-No (or poor) illustrations and teaching aids 5-No provisions made for individual differences in assignments

Sample sheet No. 2

*Director, Vocational Teacher Improvement and Foreman Conference Work for South-Western Ohio, University of Cincinnati, Cincinnati, Ohio.

STEPS	100 A=4 93 Checking Points for EXCELLENT LESSON	92 B=3 85 Checking Points For GOOD LESSON	84 C=2 77 Checking Points For FAIR LESSON	76 D=1 70 Checking Points For POOR LESSON	69 F=0 0 Checking Points For FAILURE LESSON
APPLICATION STEP III	1-Students exhibit confidence in applying knowledge or doing job 2-None or slight instructor assistance necessary 3-Application to problem or job obvious 4-Systematic attack of problem or job apparent	1-Most students show confidence in applying knowledge or doing job 2-Some instructor assistance necessary 3-Most students see the application of the knowledge or job 4-Most students attack the problem or job systematically	1-Some students show confidence in applying knowledge or doing job 2-A considerable number of students require assistance 3-Some students see the application of the knowledge or job 4-Some students "get at" the problem or job systematically	1-Only a few students exhibit confidence in applying knowledge or doing job 2-Few students can proceed without assistance 3-Few students see the application of the knowledge or job 4-Few students know how to attack the job or problem systematically	1-Students show no confidence 2-All students need assistance 3-Apparently no students see applications of lessons 4-No system apparent
TEST STEP IV	1-Mastery of skills information or knowledge excellent 2-Check questions answered perfectly first time 3-No hesitation exhibited in test step 4-Satisfactory speed, accuracy, and precision attained	1-Most students master the skill or gain the information or knowledge the first time 2-Nearly all students answer check questions correctly first time 3-Very little hesitation exhibited in test step 4-Considerable speed, accuracy, and precision attained	1-Some students master the skills or learn the information or knowledge the first time 2-Some students answer check questions correctly first time 3-Some hesitation exhibited in test step 4-Some students attain satisfactory speed, accuracy, and precision	1-A few students master the skills or gain the information or knowledge the first time 2-Few students answer check questions correctly the first time 3-Considerable hesitation exhibited in test step 4-A few students attain satisfactory speed, accuracy, and precision	1-None has mastered skill, or information, or knowledge 2-Check questions failed 3-Indifference and confusion exhibited 4-None attains satisfactory speed, accuracy, and precision

Sample sheet No. 2 continued

sample units can be made, the more worth while will these units be in developing better techniques of teaching and of conference leading.

Literally thousands of check sheets and rating scales have been developed for this purpose, and the ones submitted on these pages are presented as representing simple, sensible, and usable scales that will make

CHECK SHEET FOR RATING INSTRUCTION UNIT

NAME OF INSTRUCTOR _____ DATE _____

NOTE: Rate the items listed on this rating sheet on the basis of A (Excellent), B (Good), C (Fair), D (Poor), and F (Failure). List strong points, weak points, and definite suggestions for improvement on the back of the sheet under the proper headings.

I. GENERAL INFORMATION
- A. Clearness of aim or objective of lesson ____
- B. Evidence of teacher preparation of unit ____
- C. Apparent knowledge of lesson material ____

Av. ____

II. GENERAL ATMOSPHERE OF THE CLASS, STUDENT OR STUDENTS
- A. Attentiveness ____
- B. Cooperativeness ____
- C. Apparent effort ____

Av. ____

III. TEACHER ATTITUDE AND CHARACTERISTICS
- A. General appearance ____
- B. Personality ____
- C. Voice (harsh, squeaky, too loud, or too soft, etc.) ____
- D. Enunciation and emphasis ____
- E. Freedom from mannerisms ____
- F. Patience and thoroughness ____
- G. Use of humor ____
- H. Attitude (friendly, reserved, familiar, etc.) ____
- I. Use of appropriate English ____
- J. Teacher activity ____

Av. ____

IV. RESULTS
- A. Instruction steps well brought out (consult rating procedure chart)
  - 1. Preparation ____
  - 2. Presentation ____
  - 3. Application ____
  - 4. Test ____
- B. Student interest ____
- C. Quality of student questions ____
- D. Student participation in class discussion ____
- E. Student application of lesson, or ability to do the job ____
- F. Instructor's method of testing mastery of the lesson ____

Av. ____

Total Av. ____

Sample Sheet No. 1. Front of instruction unit rating sheet

these sample teaching experiences more meaningful to the members of the vocational teacher improvement and conference classes. These rating materials have been developed over a period of years devoted to teacher training and conference work, and, of course, represent the pooled opinions of many vocational teachers, foremen, vocational teacher trainers, and con-

V. STRONG POINTS OF LESSON _____

VI. WEAK POINTS _____

VII. SUGGESTIONS FOR IMPROVEMENT _____

Reverse side of instruction unit rating sheet

ference leaders. The check sheets and rating scales have been put in their present forms by the staff of the Department of Vocational Education, Teachers College, University of Cincinnati and the various vocational teacher improvement classes of South-Western Ohio carried on by Teachers College, University of Cincinnati, in cooperation with the State Board for Vocational Education, Division of Trades and Industries. It is hoped that the suggestive check sheets and rating charts described on the following pages will prove of value wherever sample teaching units are offered for criticism.

The Lesson Check Sheet and Rating Chart

The complete rating scale for the sample lesson consists of two parts: a check sheet (Sample sheet No. 1) used for the actual grading, and a suggestive lesson procedure rating chart (Sample sheet No. 2) to be used as a guide in arriving at sound judgments as to the quality of the teaching in the four steps of the Allen type four-step lesson, the teaching method used in practically all areas of vocational education.

The use of the sheets is almost self-evident. All members of the class listening to the sample teaching unit are supplied with both the check sheet, and the procedure chart. After observing the sample lesson, each rater assigns A, B, C, D, or F grade values directly to the various teacher characteristics and techniques listed on the face of the check sheet under:

I. General information
II. General atmosphere of the class (student or students)
III. Teacher attitude and characteristics
IV. Results

On the back of the sheet appear the items

V. Strong points of the lesson
VI. Weak points

CHECK SHEET FOR RATING CONFERENCE UNIT

NAME OF INSTRUCTOR _____ DATE _____

NOTE: Rate the items listed on this rating sheet on the basis of A (Excellent), B (Good), C (Fair), D (Poor), and F (Failure). List strong points, weak points, and definite suggestions for improvement on the back of the sheet under the proper headings.

I. GENERAL INFORMATION — GRADES
- A. Clearness of aim or objective of conference as brought out in the Introductory Statement ____
- B. Evidence of leader preparation for the unit, (Operation sheets, charts, etc.) ____
- C. Apparent command of the materials needed ____
- D. Appropriateness of the topic ____

Av. ____

II. GENERAL ATMOSPHERE OF THE CONFERENCE GROUP
- A. Attentiveness and interest ____
- B. Cooperativeness ____
- C. Apparent effort to contribute ____

Av. ____

III. LEADER ATTITUDE AND CHARACTERISTICS
- A. General appearance ____
- B. Personality (general impression) ____
- C. Voice (harsh, squeaky, too loud, or too soft, etc.) ____
- D. Enunciation and emphasis ____
- E. Freedom from mannerisms ____
- F. Patience and thoroughness ____
- G. Use of humor and tact ____
- H. Attitude (friendly, reserved, familiar, etc.) ____
- I. Use of appropriate English ____
- J. Resourcefulness ____

Av. ____

IV. RESULTS
- A. Conference steps well brought out (Consult rating procedure chart)
  - 1. Introductory statement ____
  - 2. Collecting and classifying data ____
  - 3. Selecting and evaluating data ____
  - 4. Reaching a decision ____
  - 5. Making a plan ____
  - 6. Summary ____
- B. Group interest in the subject ____
- C. Quality of group responses ____
- D. Distribution of responses ____

Av. ____

General Av. ____

Sample Sheet No. 3. Front of conference unit check sheet

V. STRONG POINTS OF CONFERENCE _____

VI. WEAK POINTS OF CONFERENCE _____

VII. SUGGESTIONS FOR IMPROVEMENT _____

Reverse side of conference unit check sheet

VII. Suggestions for improvement
(See sample sheet No. 1.)

Each main caption contains several appropriate subdivisions, and item A under "Results" concerns the four steps of the Allen Plan used so widely in vocational teaching and adopted practically bodily in the four steps of the Job Instruction Training — Training Within Industry — training programs. After the other items in the check sheet are filled out, the four steps under IV-A are rated in connection with the suggestive lesson — procedure rating chart (Sample sheet No. 2). This chart sets up groups of elements indicating quality of accomplishment for each step of the lesson. Five quality groups for each step suggest performance levels warranting grades of A, B, C, D, or F. After determining the quality of each item under section IV-A of the check sheet, the different sections are then averaged separately, and a final average grade is secured for the entire teaching unit. The usual letter-averaging procedure of assigning number values to the letters — A = 4, B = 3, C = 2, D = 1, F = O, then averaging the numbers and reconverting the average number back to its nearest letter value — is the simplest and easiest method to disclose the average letter at once.

Obviously the use of these two sheets with their rating elements cannot make lesson rating entirely objective. However, it *can* make the process much less haphazard and plain guesswork than would otherwise be the case. To make the rating procedure even more meaningful and productive of constructive thinking regarding the whole subject of lesson procedures, the back of the lesson check sheet contains spaces for listing V (Strong Points of the Lesson), VI (Weak Points), and VII (Suggestions for Improvement). Item VII makes for constructive, positive thinking rather than allowing negative thinking only. These spaces also provide opportunities to record individual opinions beyond the capacity of almost any check sheet.

After the check sheets have been completely filled out and turned in by the various members of the class, a composite report is worked out, either by the instructor, or by a member of the group to whom the task has been assigned. This composite report should list in tabular form various letter grades assigned to the different elements of the check sheet by all the observing teachers. It should also list the strong points, weak points, and suggestions for improvement presented by the different members of the class. This composite report should then be duplicated and be distributed at the next vocational teacher improvement class meeting. The reports should be carefully reviewed and discussed with the class before the next sample teaching unit is taken up. Many commonsense suggestions for improving teaching techniques arise from such discussions.

The Conference Check Sheet and Rating Chart

The conference check sheet (Sample sheet No. 3), and the suggestive conference procedure rating chart (Sample sheet No. 4) are very similar in form to the check sheet and rating chart already explained for use in connection with the Allen four-step lesson. Thus the front of the conference check sheet contains the following main headings:

I. General information
II. General atmosphere of the conference
III. Leader attitudes and characteristics
IV. Results

The back of the sheet presents:

V. Strong points of the conference
VI. Weak points of conference
VII. Suggestions for improvement

While most of the divisions of this sheet are quite similar to the divisions on lesson check sheet, section IV, *Results of the Conference,* differs radically in that it contains rating provisions for the six steps of a well-conducted conference, viz.:

1. Introductory statement
2. Collecting and classifying data
3. Selecting and evaluating data
4. Reaching a decision
5. Making a plan
6. Summary

The suggestive conference rating chart (Sample sheet No. 4) that accompanies the check sheet just described, while similar to the lesson procedure rating chart, concerns factors relating to the qualities of conference leading. The general pattern and use of this chart are similar to those described for the Allen four-step lesson.

As in the use of four-step lesson check sheets, the conference check sheets should be collected after they are filled out at the end of the conference, and the results should be compiled as composite reports to be distributed for discussion at the next conference session. The review of these composite reports should immediately follow the review of the conference to which they relate. Succeeding conferences should be opened with these reviews.

Summary

The check sheets and suggestive rating charts described in the article are offered as devices that will do much in making methods classes of various types, and foreman conferences much more interesting and effective. No claims are made that the development of these sheets has been entirely scientific, or that they are perfect rating devices. However, the use of similar devices over a period of years has convinced the writer that they are extremely valuable in improving vocational teaching and conference leading.

SUGGESTIVE CONFERENCE RATING CHART
(For Rating the Conference Procedure)

CONFERENCE STEPS	100 A=4 93 Checking Points For EXCELLENT	92 B=3 85 Checking Points For GOOD	84 C=2 77 Checking Points For FAIR	76 D=1 70 Checking Points For POOR	69 F=O 0 Checking Points For FAILURE
1-INTRODUCTORY STATEMENT Check 1 2 Av.	1-Thorough and complete understanding of topic was established 2-Much interest was aroused in entire group	1-Good understanding of topic was established 2-Good interest was aroused	1-Some understanding of topic was established 2-Some interest was aroused	1-Little understanding of the topic was established 2-Little interest was aroused	1-Very little or no understanding of topic was established 2-Very little or no interest was aroused
2-COLLECTING AND CLASSIFYING FACTS AND DATA Check 1 2 Av.	1-Excellent distribution of responses was secured 2-Very wide variety of appropriate conference devices was used 3-Chart headings very appropriate and well chosen 4-Complete tabulation of all data put on blackboard 5-Group kept on track consistently without detours	1-Good distribution of responses was secured 2-A wide variety of conference devices was used 3-Chart headings appropriate and well chosen 4-Data was well tabulated on blackboard 5-Group kept on track with few detours	1-Fair distribution of responses was secured 2-Some variety of conference devices was used 3-Chart headings fairly appropriate and chosen 4-Fair blackboard tabulation of data was secured 5-Group off the track part time; some detours	1-Little understanding of the topic was established 2-Little interest was aroused 3-Chart headings inappropriate and poorly chosen 4-Some tabulation secured; some materials omitted 5-Group off track with many detours	1-A few individuals monopolized the discussion 2-Only one or two devices used 3-Chart heads caused conflicts in classifying data 4-Much material omitted from blackboard tabulations 5-Group off the track as much as on.

Sample sheet No. 4

CONFERENCE STEPS	100 A=4 93 Checking Points For EXCELLENT	92 B=3 85 Checking Points For GOOD	84 C=2 77 Checking Points For FAIR	76 D=1 70 Checking Points For POOR	69 F=O 0 Checking Points For FAILURE
3-SELECTING AND EVALUATING DATA Check 1 2 Av.	1-Data that applied to the topic were very carefully selected 2-Evaluation procedure fitted data excellently 3-Evaluation was made very carefully and very thoroughly	1-Data that applied to the topic were well selected 2-Evaluation procedure fitted data well 3-Evaluation was made carefully	1-Some selecting was made of data that applied to topic 2-Evaluation procedure fitted data with some difficulty 3-Partial evaluation was made	1-Little effort was made to select data that applied 2-Evaluation procedure fitted data poorly 3-Little evaluation was made	1-Very little or no selection was made of data that applied 2-Evaluation procedure fitted data very poorly 3-Very little or no evaluation was made
4-REACHING A DECISION Check 1 2 Av.	1-Complete agreement was secured readily 2-All agreements reached were sound and logical 3-Decisions reached completely covered objective of conference	1-General agreement was secured quite readily 2-Most agreements were sound and logical 3-Decision reached covered objectives very well	1-Partial agreements were secured on most points 2-Some agreements were not sound and logical 3-Decisions reached covered most objectives	1-Little agreement was secured 2-Many agreements were not sound and logical 3-Decisions reached covered some objectives	1-Little or no agreement was reached 2-Most agreements were not sound and logical 3-Decisions reached covered few or no objectives
5-MAKING A PLAN Check 1 2 Av.	1-Excellent workable plans were developed 2-Plans were entirely logical in relation to decision reached	1-Good workable plans were developed 2-Plans were very logical	1-Plans were mostly workable 2-Plans were fairly logical	1-Plans were workable only with difficulty 2-Plans had little connection to decisions reached	1-Plans were developed with great difficulty 2-Plans had very little or no connection with decisions reached
6-SUMMARY Check 1 2 Av.	1-All important points of conference were covered completely 2-Excellent emphasis was given to all important points, decisions and plans	1-Most important points covered well 2-Good emphasis was well distributed to important points, decisions and plans	1-Many important points covered 2-Emphasis was given to many points	1-Some important points covered 2-Some emphasis given to some points	1-Very few important points were covered 2-Little emphasis given to important points

Sample sheet No. 4 continued

Objectives of the Social Studies in Vocational Schools

*Max Berger**

Shop teachers in vocational high schools often wonder just how the social studies are contributing to vocational education. Some regard it as merely a parasitic nuisance imposed by the provisions of the Smith-Hughes Act. Vocational school students are equally cynical, and have been heard to remark that the sole purpose of social studies courses is to provide jobs for the teachers.

There is criticism from the academic high schools also. On the one hand, they attack vocational school social studies courses as too vague and general. "Just what is encompassed by such courses as industrial history or vocational economics?" they demand. On the other hand, specific courses, such as the history of printing, which correlate closely with the student's shop interests, are condemned as being too narrowly vocational.

The basic cause for the ambiguous position of the social studies program in the vocational schools can be traced back to a lack of understanding of its true objectives. What are these objectives? Fundamentally, they are the same as those of the social studies in the academic schools, or in any other branch of the secondary schools. Generally speaking, all secondary education aims to enrich the lives of the students, and to develop their abilities and powers to the fullest possible extent. All pupils, regardless of the type of secondary school they attend, should be prepared to take their places in a democratic society.

How can the social studies program in the vocational schools assist in the achievement of these general goals? What are the specific goals of the social studies?

The first goal is the inculcation of a certain basic knowledge in the field of the social studies. The teaching of facts has been under fire for many years. Yet, without facts thinking is impossible, and without thought how can the vocational student be expected to comprehend the complex problems of the modern world? True, the vocational student is not especially enthusiastic about studying "facts," but for that matter which student is? However, if history is made meaningful by the teaching of broad movements in the development of civilization, rather than the memorization of isolated names and dates, this problem can be overcome. The ultimate aim of this phase of the work is to give the student a better understanding of the people and events of our own time.

*Chairman, Social Studies Dept., Manhattan High School of Aviation Trades, New York City.

The development of reasoning power and critical judgment is a second goal of the social studies program. A number of devices are utilized for this purpose. Cause-effect relationships in history and economics are stressed. So is problem solving. An example of the latter is, "If the War of 1812 was fought over the impressment of seamen, why did New England oppose the war?" The organization of ideas is essential in all the social studies, and particularly so in history. Various mediums are used for developing this ability. Prominent among these is the outline. When a student has learned how to outline the history of the regulation of business by the government, or the changing interpretations of the Monroe Doctrine, he has accomplished something. At all times the student is trained to distinguish between fact and opinion — a matter of great importance in an age of high-pressure propaganda.

All subjects in the school curriculum aim to train the student in methods of independent study. In this respect, the social studies contribute more than an equal share. Daily assignments, supervised study, group discussion, special reports, club programs, and special outlines, all play their part in achieving this goal.

Like all other subjects in the vocational school, the social studies is interested in the formation of certain specific habits and skills. Of prime importance is the proper use of text and reference books in the field of social studies. Few high school students are familiar with the functions of the table of contents, the index, or the appendix of a book. It is the job of the social studies teacher to see that students learn how to utilize these properly. Among the skills that are desired is familiarity with the various types of map projections and their uses. This will aid the student in understanding not only historical maps, but also current war maps and the greatly overpublicized polar projections or "air age" maps.

Another desirable skill which the social studies tries to inculcate is the ability to hold an orderly discussion. There is little occasion for the latter in shop subjects where the students are usually engaged in manual activity, nor even in the related technical subjects. But instruction in the social studies is largely based upon class discussion of problems, movements, theories, developments, etc. It is here that students learn how to state their ideas so that they can be understood by others; here that they acquire practice in defending their own viewpoints. Such training is not easy, yet it is one which the social studies bears almost alone. In time the better students are not only able to conduct such discussions, but they also acquired the ability to draw inferences and to make generalizations.

Teachers in the vocational schools are often told that the function of the social studies program is to teach good citizenship. This is a broad order, for good citizenship is the ultimate aim of all public education, not of the social studies alone. However, in most cases what is actually meant is training in desirable patterns of conduct. The loss of church and family control over the children places a greater burden upon the schools in this respect than was ever true before. It is necessary for all school departments to cooperate in establishing proper discipline and correct social attitudes. No single subject can be expected to do this alone. But the social studies department is the one best fitted for inculcating certain of these desirable behavior patterns. Among these are faith in democracy and the American way of life, a sane patriotism, respect for minority groups, suspended judgment on controversial issues, and the ability to discuss differences of opinion in an orderly fashion.

The social studies teacher does not claim that all his objectives are always realized. He is not a miracle worker. No subject is 100 per cent effective. This does not, however, detract from the value of those goals which are attained. The best proof of the value of the social studies is to be found in the vocational high school graduate. Few would deny that he has profited from his work in the social studies. None would deny that he is a better citizen than when he first entered the school.

The Industrial Arts Planning Committee of the A.V.A. has applied its efforts so far to the study of the following four distinct problems:

1. Aircraft education which should be made a part of the industrial-arts program in public schools.

2. The need for state supervision in the field of industrial arts and procedures for such supervision.

3. Desirable curriculum revisions for the preparation of teachers for industrial-arts education in American public schools to meet immediate and postwar demands in this field of education.

4. The presentation of a bulletin setting forth values and the logical position of industrial-arts work in public schools as a means of preparing youth to live effectively in our industrialized social and economic life. — *Emanuel E. Ericson,* Professor of Industrial Education, University of California, Santa Barbara, Calif.

Tooling the Electrical Course for War

*Don R. McMahill**

At the start of World War I, Elbert Jull, now instructor of electricity at Omaha (Neb.) Technical High School, was active for nearly two years in the Eighth Field Signal Corps "Over There."

Defense preparation, with the definite trend toward this country's entrance in World War II, found Jull adapting his instructional program to the needs of industry and the military forces. The need for trained electricians in World War I was apparent to Jull, and long before the final order to "tool up the vocational electricity curriculum for defense" was issued, Jull had so revised his course and was ready. He made due allowance for peacetime needs, however, knowing that the successful conclusion of the war would create a need for practical, boom-time electricians, such as were in great demand during the ten years following World War I.

Today, with the war actually exceeding that of Jull's experience, he has again modified his curriculum. He says:

Just as we had completed the course to cover the requirements for pre-induction, the large demands of industry for men in war plants came to us. It therefore became necessary to meet the requirements of both.

Now we have 78 per cent of our boys in industry part time and we bring them back to the classroom for one hour each day to give them the things that industry will not cover for them. They must have, at the same time, essential new developments that their industrial jobs do not cover.

Class work, for instance, includes electronics, vacuum tube phenomena, and they get this through lectures and demonstrations. These subjects are emphasized for radio servicemen, the men in steel plants, and others who will have an opportunity to apply in industry what they study at school.

A careful survey of placements was made. It became apparent that the electricity course should be designed to give high school boys an opportunity to have experiences in nearly all of the fields of electrical work.

Omaha's Martin-Nebraska Bomber plant was under construction; the famous "B-26" would be helpless without the life lines of modern electricity.

In peacetime, the city thrived as a railroad center. The packing industry required constant servicing. Yes — war created a terrific demand for apprentice and experienced electricians.

Visual education was introduced in the classroom to speed vital facts. Jull says:

Armature circuits are taught through use of visual slides made in the school's own chemistry laboratory. This method seems to be the answer for the boy who is preparing to attend electrician's mate school in the Navy, to work in the winding shops of the local railroads, to enter the repair and service shops of bomber plants and packing houses.

Three-phase motor connections are explained by assigning the students to outline motor connections on a skeleton motor projected on the blackboard by lantern slides. Small industries working on subassemblies for war plants need young workers who understand this simple operation. Again, the navy wants such men in the Fire Controlman's school.

Refrigeration theory is given for air conditioning work for the railroads, and for the Navy, Army and Merchant Marine. National Underwriter's code is given for wiring defense plants and for the Navy schools. Telephone circuits are included so that our young graduate may work for the telephone industry or the Army Signal school as well as the Navy C. B., the ship repair unit.

With all this adjusting, what has become of the peacetime objectives and the weekly unit plan?

Twelve weeks are given to each subject, both for the boys who are regularly in school and those who are in industry part time. The regular full-time students are held in school on projects which constantly come up.

Technical High School, perhaps the largest semitrade school between the Mississippi and the Rocky Mountains, remains open day and night. Evening classes and night school for upgrading defense plant workers, coupled with normal day school operations, place a heavy drain on the plant's electrical system.

Yesterday, for example, our intricate bell system broke down. A crew was assigned to locate the trouble, repair it, and submit a report to the class. Tomorrow, the clocks may fail — a habit, it seems, when cold weather arrives. Electrical equipment used in our school cafeteria is often brought in . . . a problem to be solved by our "trouble crew."

Faculty members, too, have learned that a faulty toaster, heater, radio, motor, in fact any home appliance, can be serviced by Jull's repairmen. In view of the current man-power shortage, they keep the electrical department supplied with projects.

These servicemen have had one year in prevocational electricity before they undertake Jull's program. The prevocational course, designed by the War Department, is a basic outline prepared from technical and field manuals of the War Department.

Our graduates are in every phase of military service. They are instructors in the service schools for the artillery, signal corps, Navy and Navy C. B. They are in every part of the world. And the letters I receive from them make me proud to have done something to speed their preparation and, indirectly, the ultimate victory.

For schools in communities not so actively engaged in war work and industrial part-time labor, the following program may be helpful.

Two of six periods daily are used for related information, informal discussions, questions and answers. This class time is known as "T.K." — Trade Knowledge.

This related information is given in sequence so that each boy will get a full series in two years, regardless of the time he enters.

Information includes the following:

One 12-week quarter for each topic.

Vacuum tubes, armature circuits and alternating currents, house wiring circuits and national code, blueprint reading and estimating, electrical refrigeration, alternating current motors and controls.

The four periods of shopwork daily are divided according to grades as follows:

11A — Construction of electric arc soldering rig. This is given in connection with job and information sheets to enable the student to develop general mechanical skill, ability to follow instructions carefully, and to develop neatness in production. One complete quarter is allowed.

11B — House wiring circuits. This is given with job information sheets to give the boy a chance to apply some of the provisions of electrical code as well as to acquaint him with some of the circuits in house and power wiring. A full course in house wiring cannot be taught in the school laboratory, and this unit is designed to help the boy discover whether he is fit and capable of becoming a house wireman. Boys from this part of the course are used to service lights in the school plant.

11C — Alternating current measurement. This is given through use of job sheets and reference books. The unit is intended to give the boy experience in the use of devices to measure alternating currents and to discover some of the applications of alternating currents. There is no job where instruments will be used exclusively and this knowledge is of general nature, applicable in any field.

12A — Cable splicing and telephone work. Job sheets, information sheets, and reference books direct this unit. The boy may learn whether or not he has the "fine touch" and high mental co-ordination so necessary in legitimate telephone work. Boys from this unit are used to service the telephone system within the school plant.

12B — Vacuum tube work. Again, job sheets, information sheets, and reference books are used. The use of vacuum tubes in commercial work is now as great as the use in radio work. This unit is designed to give the boy experience in the use of vacuum tubes in all fields.

12C — Continuation. This unit permits the boy to continue in the field of his own selection — the one for which he feels best fitted. He continues to explore, under supervision, the various phases of electricity. He learns to work under poor conditions, to improvise, to create new tools for new situations. He is encouraged to further his knowledge in his chosen field through study of advanced reference books. All the while, his activity is centered around one certain ability or skill which has become apparent. That primary "seed" or "spark" seems to be a true indication of what he will in later years develop into a lifetime trade.

*Omaha, Neb.

INSTRUCTION SHEETS

*Edward N. Wallen**

Just as a journeyman worker in a trade is expected to possess and keep in order the hand tools peculiar to his trade, so should the industrial teacher acquire as soon as possible a good working kit of teaching tools. Unlike the tradesman, however, the teacher usually has to make most of his own tools. One of the most important tools available to the industrial teacher is the instruction sheet.

Whether the shop teacher uses operation sheets, project sheets, or regular working drawings, he is confronted with the necessity of deciding on the kind of paper, etc., that will be suitable for the job. He has to consider the making of the sheet, the handling by the students, and the effective life of the sheet.

The instruction sheets may be one of several types. Large drawings may be made and mounted on a special bulletin board or similar types of mounts. These may be displayed at convenient places in the shop where the student may readily consult them. This form has the disadvantage of compelling the student to leave his work to see the details and dimensions of the object depicted. This in turn is a source of distraction to other students besides providing an excuse for lingering in a group around the board for a chat.

The various types of duplicating pads, such as the old style hectographs, are a convenient means of making a limited number of individual sheets, but the making of them is a slow process and the resulting sheets frequently are indistinct and difficult to read.

Much better and faster work, of course, can be produced when modern gelatin duplicators of the Ditto type are used. Mimeographed sheets are easily made as the work of cutting the stencil is the biggest part of the task. The stencil may be used indefinitely if care is taken to hang it up after using until it drys, and then storing it away.

Whatever method of duplicating is used, the lesson sheets may be mounted on cardboard and the faces preserved by shellacking. Or, since the sheets are produced so easily, it may be advisable to have the students keep them in notebook form for future reference.

Most shop teachers prefer the blueprint form of sheet as being more appropriate for the shop. Blueprints are the most expensive form of sheet but it is possible to use them for a long time by protecting them while in use. Unmounted prints soon get so crumbled and dirty that it is difficult to read them. Slipping the sheet into a celluloid container preserves the surface indefinitely, but the containers are costly and the celluloid is soon scratched so that much of the visibility is lost.

In some shops the prints are mounted on a piece of sheet metal and the surface is shellacked. This is effective, but if there are many prints in the teacher's kit they are too heavy to be moved around.

Probably the cardboard mount is, all things considered, the best. A hard surfaced mount, used in mounting photographs, can be bought for about a cent each in the 8 by 10 size. Both sides of the mount may be used. Library paste or a paste made of cornstarch is suitable.

As soon as the print is pasted to the mount it is necessary to put the mount under a pressure to keep it from warping. In the event that a sufficient amount of blotters are unavailable, an old telephone book will serve very well. A large number of prints can be placed between the leaves of such a book. Care should be taken to shift the prints within a few minutes after placing under pressure, because the surplus paste may cause the print to stick to the leaves of the book. If this should happen a dampened cloth will usually remove the sections of pages from the print surface.

After the prints are dry, strips of very light tin should be placed over the edges so that they project onto the surface about ¼ in. The tin may be securely fastened by center punch marks which will indent the tin into the cardboard. The faces are shellacked. After the prints show signs of wear, they should be given a new coat of shellac. The mount will last for a considerable time without the tin but experience has shown that many boys will absentmindedly hit the edges against a bench or other hard surface often enough to spoil them. A strict inspection of the tin binding should be made to see that no sharp edges are present which may cause cuts. Some of the prints mounted in this manner have been in constant use for over four years and are still in good condition.

The blueprints may be made in school at a great saving of time to the teacher. The students also benefit by obtaining a knowledge of blueprinting. If the sun is not available for making the blueprint, a 300-watt daylight lamp with a good reflector will give satisfactory results, but the method is very slow, and it should not be attempted on larger than the 8 by 10-in. prints.

The teacher should decide on a standard size for his sheets. The 8 by 10 outside dimension with a border ½ in. smaller all around is recommended. It may be filed conveniently in a standard file, and ordinary typewriter paper may be used for making the originals. Very good prints may be made from typewriter paper if the typing is done while backing the sheet with a carbon copy sheet so that the double impression is obtained. A few drops of clear oil should then be rubbed on the paper to make it transparent. The oil must be dry before a print is made.

*Straubenmuller Textile High School, New York, N. Y.

BACK TO BATAAN!

ADAM N. REITER*

— Back to "The Islands"!
— Back to Bataan!
Back to the lines where MacArthur's men stood!
Weary and beaten, yet grimly resisting;
Marking each step of retreat with their blood!

Deep in the jungle, their fallen are resting
'Neath little green mounds with a Cross at the head —
They who return have a pledge in their keeping:
A pledge to avenge those illustrious dead!

— Back to Corregidor!
— Back to "The Rock"!
Back to the Tunnels where men bled and died!
Warrior and nurse, side by side, in their striving;
Theirs is a Saga of Courage and Pride!

Soon will the fanfare of Vict'ry be sounded;
A Vict'ry long dreamed of . . . far-reaching and vast . . .
Soon will Old Glory on "Top Side" be gleaming;
Never again to be torn from its mast!

— Back to the Foxholes!
— Back to Bataan!
Back to the scenes of betrayal and blight!
"Legions of Brave" — with MacArthur to lead them —
Nor shall they fail in their "Crusade of Right"!

Somewhere their comrades (Our Heroes) are waiting;
Strong in the Faith that our Cause shall be won . . .
Back to Bataan! . . . There must be no halting,
Whatever the Cost; 'till the Battle is done!

*West Chester, Pa.

The total area burned over each year by forest fires in the United States is about as large as New York State.— *American Forest Products Industries, Inc.*

Teaching Aids in Vocational Education

*Gilbert G. Weaver**

The use of visual aids in teaching is by no means a new idea or modern technique. Aids of this type have been used throughout the span of educational history, but not by all teachers and not as often as desirable by the better teachers. The development of motion pictures as a medium of entertainment has demonstrated the value of visual learning and consequently educators have taken a renewed and intensified interest in the use of visual instruction through the media of models, photographs, charts, exhibits, and projected pictures.

The war-training programs also have given a timely impetus to the use of visual teaching aids for creating interest and accelerating learning. It has been claimed by some of the military leaders that 40 per cent of the instructional time is saved by the use of visual methods. It is easy to appreciate this saving, if we accept the statement of psychologists that 85 per cent of human knowledge is absorbed through the sense of sight. Therefore, it seems logical to suggest that visual aids of various types be employed whenever possible, due to their importance in the learning process. The pedagogic creed of John Dewey included these statements:

" . . . the image is the great instrument of instruction. What a child gets out of any subject presented to him is simply the images which he himself forms with regard to it.

" . . . if nine-tenths of the energy at present directed towards making the child learn certain things were spent in seeing to it that the child was forming proper images, the work of instruction would be indefinitely facilitated.

" . . . much of the time and attention now given to the preparation and presentation of lessons might be more wisely and profitably expended in training the child's power of imagery and in seeing to it that he was continually forming definite, vivid and growing images of the various subjects with which he comes in contact in his experience."

These quotations from a great educational philosopher are further evidence of the importance of visual aids as a vehicle of effective learning.

Visual Aids and Learning

It may be well to consider why visual aids play such a definite part in human learning. They are effective because they:

1. *Attract and hold attention.* The substitution of a visual aid for a verbal explanation is far more effective in attracting attention. Students may not be intrigued by the description of various kinds of wood and their finishes, but they will be attracted and interested immediately in samples of various woods finished with a variety of stains and paints.

2. *Aid retention of information and visual image.* The majority of the things we hear is forgotten in a relatively short period of time and it is not possible to recall accurately what we hear. On the other hand, the things we see make a more or less lasting impression and we experience considerably less difficulty in recalling the visual image. It is highly probable that we would easily forget the explanation of how an electric bell rings, but if the explanation is supplemented by a real bell or model, the impression is fixed and enables us to recall the procedure or operation.

3. *Assist in forming correct images.* People interpret things in terms of their own background of experience and consequently it is possible for a group of learners to form entirely different ideas about the same object as a result of a verbal description. One might describe the appearance and working properties of a fireless cooker, but the best explanation is highly inadequate as compared with a display of the thing itself, or of a substitute — a picture or a model of the cooker. It is essential that visual aids be used whenever possible in order that the learner may avoid the formation of incorrect mental images.

4. *Assist in understanding proper relationships of component parts.* A visual aid, whether it be a model, sketch, photograph, or the thing itself, will establish in the mind of the student the proper relationship of the various parts of the thing under consideration. A verbal explanation is not sufficient to understand these relationships. The best explanation of an automobile gearshift is highly inadequate without a working model, preferably of the cutout type, by which one can observe the function of the shift lever, the gears, and the clutch.

Effectiveness of Visual Aids

Visual aids, in order to serve effectively in the teaching process, are dependent on the way in which they are constructed. Several of the important factors to keep in mind while devising visual aids are:

1. *Use of color.* Color is a most potent feature and should be used whenever possible. A chart in color is to be preferred to one in black and white. A cutout model, with the cut parts painted, enhances its value. A colored film or slide is particularly impressive. Many times color is necessary to clear understanding, as it presents the object or situation as it actually exists.

2. *Simplicity of construction.* There are times when a simple model or diagram will clearly explain a rather complicated mechanism. It is possible to construct a fairly simple device to explain the operation of an automobile brake or a differential. The visual aid is of value only when it tends to clarify an otherwise complicated tool, operation, machine, or process.

3. *Importance of size.* There are situations when the real object is too small for use while instructing a group. It is necessary, in such cases, to devise a visual aid to suit the situation. It will be found advantageous to have enlarged models of such things as a vernier caliper, slide rule, distributor head, and the like. The large scale model is more rapidly comprehended and, furthermore, it is possible to teach a larger group at one time with satisfactory results. The enlargement itself is impressive and attracts attention and develops interest, all of which are direct contributions to learning.

There are also times when a reduced model is necessary and very helpful. Miniatures of roof, framing, house framing, and similar small scale representations are very effective in teaching. The reduced model sometimes places the learner somewhat at a disadvantage as he does not see the thing in its true relationship, due to the reduced size. In the two cases cited, it may be better to have available sections made to full scale in lieu of the reduced model.

There are situations, however, where the reduced model enables the learner to visualize the relationship of the component parts to a very distinct advantage. A model of a heating system for a small dwelling is typical of this type of reduced visual aid. The miniature in this case enables the learner to see each part and its relationship to the whole.

4. *Elimination of nonessential detail.* The underlying purpose of a visual aid is to clarify and simplify the learning process and, therefore, all nonessential details should be eliminated in the construction. It is safe to eliminate all parts that do not contribute to the understanding of the principle or operation under discussion.

The Blackboard as a Teaching Device

The blackboard, although not a visual aid in itself, is the most common and generally accepted medium of visual instruction. Teachers in general, and vocational teachers in particular, should develop expert skill in the use of this teaching tool. Well-executed pictorial drawings, diagrams, and graphs will reduce the necessary amount of verbal instruction and thus aid the learner in understanding and recall. The majority of teachers have failed to appreciate the advantages of blackboard presentation and, therefore, they have made no special effort to become proficient in its use.

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There are times when the sketches should be drawn before the period in which they are to be used. This is particularly true in the case of complicated devices and diagrams that would require too much of the class period to complete and would probably create impatience and discipline problems. Although the blackboard is an effective tool in the hands of the teachers, the students should be requested to use it when they are called upon to explain their understanding of a principle, device, or operation. Every vocational shop should have a blackboard available.

It is well to use colored chalk and crayon to accentuate certain parts or materials. The added attractiveness has considerable influence on student interest. Another important feature of blackboard sketching is the use of shading. It will give drawings depth and will create the illusion of a third dimension. It will be found interesting to make two identical sketches, but add color and shading to one sketch. A comparison of the two sketches will be convincing proof that color and shading are most important factors in drawing for clear understanding.

A good teacher will make extensive use of the blackboard during class presentations to vitalize the instruction. It is well to use the blackboard for all new technical words, the names of machine parts and operations, in addition to well-drawn sketches. The use of the sense of sight, in addition to the sense of hearing, is bound to increase the learning possibilities of the trainee or student.

Models as Teaching Devices

There are various kinds of models that prove to be very effective teaching devices. Models vary in size and form for different trades and different situations. It is possible to classify them into six general groups.

1. *The Cutout or Cross-Section Model*

It is important that the cut or section be made at a point where it will show to the best advantage the important interior parts of the device, e.g.:

a) *Auto or Airplane Shop.* A cutout model of an engine showing the pistons and cylinders.

b) *Machine Shop.* Cross section of a bearing showing shaft, bearing, metal, and caps.

c) *Plumbing Shop.* A toilet bowl with the plate glass cemented over, cut in such a way as to see water in action when flushed.

2. *Reduced Model*

This type is useful in showing the relationship of parts too large or complicated to bring into a shop or classroom.

a) *Plumbing Shop.* A heating or plumbing system for a house or business building.

b) *Carpentry Shop.* A window frame or door construction to reduced scale.

c) *Air-Conditioning Shop.* Small-sized ducts of different shapes, used to teach the principles of air flow.

3. *Enlarged Model*

This form of model is necessary, especially in situations when a group discussion revolves around a relatively small article. The following are typical examples:

a) *Printing Shop.* An enlarged wooden model of a piece of type.

b) *Machine Shop.* A micrometer enlarged six to ten times the regular size.

c) *Drawing Room.* A large scale model of a slide rule or an architect's scale.

4. *Actual Device, or Part of Device*

Wherever possible, the actual part is the best type of model. In some cases it may be a part of the whole device, e.g.:

a) *Cabinet Shop.* The section of a drawer showing the dovetail construction.

b) *Sheet-Metal Shop.* A transition of duct from round to square or oblong shape.

c) *Pattern Shop.* A pattern with the core box.

d) *Drawing Room.* Gears, connecting rods, levers, bearings, valves, etc.

5. *Working Model*

The working model is always very effective, as it attracts attention and holds interest. It shows "how it works" and how the parts are co-ordinated or synchronized. Such a model may be actual size, or larger or smaller than the real machine or device. The material from which a working model is made varies with the particular model. The material may be wood, iron, plastic, or other materials used in the original. It may be made of cardboard and be a sectional model.

a) *Auto Shop* or *Related Subjects Class.* A wooden cutout model of a one-cylinder engine showing the action of the cylinder and valve operated by a crank. A small electric bulb may be placed in the cylinder head and so wired as to flash at the time that the explosion should take place.

b) *Machine Shop.* Small-scale working models of a shaper, milling machine, etc., are of value when teaching related technical information.

c) *Electrical Shop.* A flat working model of a generator or motor made of plywood and cardboard showing N-S poles and a rotor that will turn.

d) *Science Room.* A working model of the solar system is the most effective way of teaching the relationship of the sun, moon, and stars.

6. *Models Showing Sequence of Operations*

It is advantageous at times to develop models showing the results of succeeding operations performed on the material or the different stages in the production of an article. There is practically no limit to the extent of such teaching aids, e.g.:

a) *Machine Shop.* The successive stages of the grinding of a tool bit shown by several pieces of tool steel, with the side clearance and back rake ground satisfactorily. The value of this teaching aid may be enhanced by adding photographs depicting the way the bit must be held for grinding.

b) *Tailor's Shop.* The succeeding steps in the production of a button hole are very valuable. The use of contrasting colored thread aids in clarifying how the stitching was done.

c) *Cabinet Shop.* A series of panels showing the steps in sanding, staining, varnishing, rubbing, polishing, and finishing different types of wood.

d) *Related Information Class.* A gear pattern, the casting, the machined blank, and finally, the cut gear.

Charts, Photographs, Sketches as Visual Aids

The best verbal instruction can be greatly motivated by the use of well-designed charts of useful information, attractive photographs of machines, equipment, installations, and carefully drawn sketches that translate abstract verbiage into meaningful instruction. Examples of these forms of desirable visual aids are indicated.

1. *Charts Showing:*

a) Decimal equivalents of an inch.

b) Tap drills for standard sizes.

c) Line drawings of machines with the parts indicated by name.

d) Oiling systems of engines and other equipment.

e) Examples of the three classes of levers.

2. *Charts Showing Enlargements of Such Things as:*

a) A welding torch with parts indicated.

b) Micrometer readings on flash cards.

c) Telephone receiver and transmitter.

d) Gear teeth and their respective parts.

3. *Photographs of:*

a) Machines and equipment not available in the schools.

b) Safe and unsafe practices (safety bulletins).

c) Special machine setup and installation.

d) Stages of progress in construction, foundations, framing, finishing, etc.

4. *Blackboard Sketches*

a) To explain special points, such as electrical connections, radio circuits, operating principles, relationship of parts of a mechanism, the shape or size of a part to be made, etc. A sketch in all of these cases will clarify vague points to a greater degree than just words.

b) To present the construction of special jobs or ideas of design to be copied by the students.

c) To clarify certain details of a job, a well-drawn sketch will result in thorough understanding. A student is frequently confused by a complicated drawing or an involved mechanism. If the instructor is capable of making a well-drawn, detailed sketch of a specific part, he can clarify the situation in a minimum of time.

5. *Exploded Drawings*

These are not new as they have been used in manufacturer's instruction booklets of household devices sold to the public. This type of drawing can be readily understood by the average layman, as the parts

are shown adjacent to each other in the approximate position as when assembled. Due to the large army of untrained personnel enlisted for the war industries, the exploded drawings have been especially advantageous in the assembly departments of large plants, in lieu of complicated mechanical drawings. They are to be recommended for many school situations because:

a) They consist of picture drawings and are naturally easy to understand.

b) The position of the different sketches on the drawing shows the relationship of the component parts.

c) The complete assembly job is easily accomplished because each part is shown in its correct position.

Exhibits

There are many displays or exhibits available through manufacturers that serve as effective visual aids. These exhibits are usually well arranged and show, in sequence, the operations or development of the product from the raw material to the finished article. Despite their possibilities as visual aids, they are sometimes used only for wall decorations. These displays are of varied types, e.g.:

1. Panels of various woods, showing the results of the use of stain, paint, etc.
2. A series of vials, showing the various kinds of oils for different purposes.
3. Samples of abrasive, from the raw material to the refined product.
4. The evolution of a lathe dog, showing the successive steps in drop forging.

These exhibits usually carry the name of the manufacturer, which is not objectionable from the standpoint of their educational value.

Projected Pictures
Slides, Motion, and Strip Films

In recent years the value of pictures in teaching has been greatly increased by technical progress in many directions and especially in the field of motion pictures and other types of projection.

Observation has shown that, although they appreciate the value of pictorial aids, many teachers hesitate to take advantage of the varied modern visual aids because they are not familiar with the potentialities of these aids and, furthermore, they are not familiar with the equipment that must be used. Planning and study are as necessary to the intelligent application of these media as with other methods of instruction used in schools. Unorganized usage is bound to limit the results that can be obtained. Benefits to students and assistance to the instructors are to be found in these media and await only the intelligent selection and use by the progressive teacher.

A single glance at a picture is many times a greater source of information to the learner than an extended explanation by the instructor. This is true because the relationships are more evident, similiarities are recognized, details are clear, and the machine or process is presented as a whole. Furthermore, many learners are visual minded and experience difficulty in interpreting the spoken word in terms of specific applications.

Slides, films, and film strips are usually made by competent persons after careful thought and preparation. The factors of good showmanship are usually employed to a major degree, e.g., color, sound, animated sketches, spot lighting things of particular interest. Due to the interesting presentation, sustained interest is retained over a longer period, thereby delaying or reducing fatigue.

Projected pictures have distinct advantages from the standpoint of learning. They are particularly effective in the following situations:

1. *Demonstrations* that are impossible, due to lack of facilities, environment or expense attached, e.g., the making of molded glassware or the smelting of copper.
2. *The functioning of hidden parts* or invisible processes, e.g., the functioning of the parts of a modern bookkeeping machine, or the cracking process in a modern oil refinery.
3. *Illustration of theories* or abstract principles in the application of scientific laws to the subject under discussion, e.g., the atomic theory or the theory of sound waves.
4. *Explanation of tools,* machines, and equipment by enlarged pictures that will enable a large group to view them at one time, e.g., the use of a micrometer, the cutting operation of a milling machine cutter, the action of a cam on an automatic machine.
5. *Acceleration of slow operations* or action and the retardation of movements too fast for the eye to observe and analyze, e.g., the acceleration in the growth of a plant, or a chemical or physical change, the retardation of a hand or machine movement such as grinding a drill, or the action of a riveting gun.

Projected pictures, because they can be expanded to great size, bring out details to the point of proper visual reception. A large class or audience can view a picture at one time without inconvenience or obstruction of view. These projected visual aids may be classified into three groups:

1. *Slides.* These are the most common type of projected pictures and the least expensive. It is advantageous to have slides of trade operations, drawings, sectional views, safety practices, and other information to be used with various classes at different times. Due to the fact that the slides are separated from one another, they permit greater flexibility in their use than is possible with film strips. It is possible to select from a large number of slides the particular ones that are appropriate for the specific lesson. It is convenient to have slides of such things as:

a) Charts and diagrams of value.
b) Good and bad shop practices.
c) Technical problems in mathematics.

2. *Slide films.* Slide films, otherwise known as strip films, usually involve a series of pictures showing the successive steps in a job or process. They are relatively inexpensive and easy to project, but they do not possess the same flexibility as slides.

This type of film has a distinct advantage in the form of absolute continuity. There can be no disturbance to the proper sequence of either the picture or the explanatory notes, as they are joined together on one strip. After the film has been properly threaded into the projector, there is no further operating procedure except to turn the projector knob to change the pictures.

It is possible for teachers to develop their own slide films for instructional purposes. A good 35mm. camera, with the usual photographic supplies available, will produce satisfactory results. The instructor can save time and effort by the use of slide films showing:

a) Sequence of operations to be performed.
b) Safety precautions to be observed on specific machine.
c) Principles of science and their application.

The slide film is widely used for instructional purposes and, consequently, it is possible to secure the films from many large manufacturers and other agencies interested in training employees.

3. *Motion Picture Films.* The motion picture has considerable advantage, although it is expensive to produce.

a) *Movement.* This, of course, is the main feature which distinguishes this medium from the one discussed previously. Where movements and actions of every kind are an important part of the subject, the use of motion pictures is of unparalleled value.

b) *Intense Interest.* This is a direct result of action, added to picturization. There are a vast number of motion picture films about people, places, events, and things which can be used for study or as background material in practically every subject.

c) *Unlimited effects.* Motion pictures can make inanimate things come to life. They can visually present flights of the imagination and they can make hypotheses come into reality. They can combine two or more complicated motions, and they can speed up or slow down at will. Animated technical drawings offer limitless possibilities as aids in technical subjects.

There is an unlimited number of motion picture films available on a wide range of subjects. It is possible to borrow these films for school showing at little or no cost excepting transportation charges. The film producers may supply animated drawings, use trick photography, supply attractive color, and running comments, retard accelerated motion and utilize good showmanship, but their efforts must be supplemented by carefully planned procedures on the part of the teachers if the films are to be used successfully for instructional purposes.

The following suggestions are represented for the use of the various types of industrial and technical films.

Step 1. Explain the purpose of the film

by showing the relationship to the topic or lesson under discussion.

Step 2. Review certain information about the topic already known by the students. Challenge the students with certain questions pertinent to the topic.

Step 3. Direct the observation of the students by indicating certain specific things they should note while viewing the picture.

Step 4. Show the picture, one, two, or more times, depending upon the complexity and length of the film. The first showing may be for a general over-all view. The second showing may be for the observation of definite details.

Step 5. Follow-up. Immediately following the showing of the film, the teacher should pose certain thought-provoking questions which will stimulate further interest in the subject and lead to a more thorough understanding. In some cases, it may be advisable at this point to show the film again for review or summary.

Step 6. Assignment. In order that the information acquired from the film may carry over into the activities of the student, the teacher should make specific assignments of work to be done, references to be read, or reports to be submitted.

Conclusion

The progressive teacher will utilize all types of visual aids whenever possible to motivate interest and increase understanding. It is necessary that every teacher give serious thought to types of visual aids he may develop or construct, in addition to those he may secure from commercial companies.

Teaching Materials for Industrial Education

*Chris H. Groneman**

(Continued from page 22 of the January, 1945, issue)

The following list of teaching aids was collated to help the teachers of the various departments of industrial arts and vocational education.

Many of the booklets and articles contained in this list have cost those who distribute them quite an appreciable amount of money. It is but courtesy to enclose sufficient postage with your request to cover mailing charges.

It is advisable that teachers use school stationery when writing for any of the items listed. All items are free unless otherwise noted. In most cases a small charge is made when free items are ordered in quantities.

Transportation

Aeronca Aircraft Corp., Middletown, Ohio
- *The Unbelievable Adventure*
- *If You Can Drive a Car You Fly Your Own Aeronca*
- *There's Something New in Light Airplanes*
- *Preflight Chart*
- *Scale Model*
- *"Mr. Grasshopper Wins His Wings"*
- *Envelope Stuffers*

Air-Age Education Research, 100 East 42nd St., New York 17, N. Y.
- *Aviation Picture Charts* (set of six) — 50c plus 10c mailing fee for each order; separate charts 10c each
- *United States Air Transport System Map*
- *Air Map*
- *The Airplane — An American Heritage*
- *Make Friends With Mexico* — 10c
- *Air Express and Air Freight Wall Chart*
- *Air Express Shipping Estimator*
- *Time Table*
- *Photographs* — 10c each
- *Posters*
- Colored Prints (small size — order by number — 1 print 10c; 3 prints 25c)
  - *No. 1. Every Mile of Every Flight Is Flown by Plan*
  - *No. 2. This Used to Be the 5:15*
  - *No. 3. Behind the Scenes*
  - *No. 4. Wings for the War of Production*
  - *No. 5. Industry Looks Aloft for Transportation*
  - *No. 6. Greetings From All of Us*
  - *No. 7. Let Me Show You the Way to Go Home*
  - *No. 8. Make Flagship Travel a Family Affair*
  - *No. 9. West With the Night*
  - *No. 10. American Helps to Keep 'Em Flying*
  - *No. 11. Here, There, Anywhere for the Air Transport Command*
  - *No. 12. When Winter Claims the Land*
  - *No. 13. There Is No Substitute for Air Transportation*
  - *No. 14. Onward to the New Dawn*
  - *No. 15. The Boundaryless Ocean of the Air*
  - *No. 16. Your Future Is in the Air*
  - *No. 17. Every Minute of Every Day and Night*
  - *No. 22. The Light of Liberty*
  - *No. 23. Wings Conquer Time and Space*
  - *No. 24. Flagships Serve Canada, the United States, and Mexico*
  - *No. 25. October Wonderland*
  - *No. 26. Flagships Fly Down Mexico Way*
  - *No. 27. Good Neighbor Mexico — Next-door by Flagship*
  - *No. 28. Flagships Bring Good Neighbors Nearer*
  - *No. 30. Yesterday There Were Frontiers*
  - *No. 31. Along American's Southern Route*
- Large size prints (order by number — 1 print 25c; 3 prints 50c)
  - *No. 100. Behind the Scenes*
  - *No. 101. Here, There, Anywhere for the Air Transport Command*
  - *No. 102. Wings for the War of Production*
  - *No. 103. American Helps to Keep 'Em Flying*
  - *No. 104. West With the Night*
  - *No. 105. An Airway Beacon*
  - *No. 106. Watch the Clouds Roll By*
  - *No. 107. Flight-Seeing New York by Flagship*
  - *No. 108. Niagara Falls*
  - *No. 109. Flagship and Clipper*
  - *No. 110. The Statue of Liberty*
  - *No. 111. The Light of Liberty*
  - *No. 112. Flagships Fly Down Mexico Way*
  - *No. 113. DC-3 in Flight*
  - *No. 114. Wings Conquer Time and Space*
- *Air-Age Education News*
- *Air World Map*
- *Into the Air Age* — 25c
- *Opportunities for Youth in Air Transportation* — 25c
- *Aviation Maintenance* — 10c

Air Express Division of the Railway Express Agency, 230 Park Ave., New York 17, N. Y.
- *Air Express Estimator*
- *Air Express Blotters*
- *There's an Air Umbrella Over America, Too!*
- *Vision Unlimited*
- *Carriers of Trade*

Allison Division, General Motors Corporation, Indianapolis, Ind.
- Lithograph charts 30 by 40 in. on 70 lb. paper:
  - *No. SS 0-11 — Coolant System in Curtiss P-40D & E*
  - *SS 015 — Relationship of Oil Pump Strainer and Relief Valves*
  - *SS A-8 — F2R & L V-1710-27 & 29 Installation in P-39*
  - *SS 07 — F3R V-1710-39 Installation in P-51*
  - *SS 012 — Allison Electrical System in Curtis P-40D*
  - *SS 0-17 — Allison Coolant System in Bell Airacobra P-39D*
  - *SS B16 — Fuel System in Bell Airacobra P-39*
  - *SS 013B — Allison Fuel System in Curtiss P-40D & E*
  - *SS B10 — C-15 Fuel System in Curtiss P-40*
  - *SS B19 — C-15 Lubrication System in Curtiss P-40*
  - *SS 010 — Lubrication System in Curtiss P-40D & E*
  - *SS B28 — Fuel Air Flow Through Supercharger*
  - *SS B2 — V-1710 F-R & E Valve and Ignition Timing*
  - *SS 014 — Allison Oil System in Lockheed P-38E*

*Industrial Education Department, A. & M. College of Texas, College Station, Tex.

SS 013A — Allison Fuel System in Curtiss P–40D & E
SS A–6 — Allison E–4 V–1710 Installation in P–39C
SS A–7 — Allison E–4 Lubrication System in P–39C
SS B22 — C–15 Ignition and Electrical System in Curtiss P–40D & E
SS 0–9 — F–3R Installation in Curtiss P–40D
SS 0–20 — Coolant System in Lockheed P–38F
R7 — Lockheed P–38F Fuel System in Allison F5R & L V–1710–49 & –53
S–3 — Bell P39F — Electrical System — Allison E4 — V–1710–35
P–8 — North American P51 Coolant System — Allison F3R — V–1710–39
N–6 — North American P51 — Oil System — Allison F3R — V–1710–39
R–6 — North American P51 Fuel System — Allison F3R — V–1710–39
S–4 — North American P51 & A36 Electrical System Allison F3R & F21 R — V–1710–39 & –87
R–5 — Typical Fuel System Components
B–29 — Engine Cross Section Through No. 6 Cylinder
J–10A — Automatic Manifold Pressure Regulator
F–13 — Allison Accessories Gear Train V–1710 Right Hand Engine
F–25 — Allison Accessories Gear Train — V–1710 Right Hand Engine with Synchronizers
F–26 — Allison Accessories Gear Grain — V–1710 Left Hand Engine
SS–026 — Turbo Supercharger & Regulator
SS–B31 Cylinder Bank Construction
C–1 — Electrical System Diagram
J–1 — Stromberg Injection Carburetor Diagram
SS–B — Allison V–1710–33 C15 Engine Valve & Ignition Timing
SS–08 — Allison "F" Type Engine Lubrication System V–1710–27, 29, 39, 49 & 53 Engines
SS–B12 — Allison V–1710 F2L Engine Valve & Ignition Timing
SS–S5 — Electrical System P–38–Lockheed
SS–P9 — Cooling System — A–36 — North American
SS–N7 — Oil System — A–36 — North American
SS–R8 — Fuel System — P–51 & A–36 — North American

(Price each for above charts postpaid — $1)

Allison Service School Handbook — $1
Pilots Handbook for Operation and Maintenance of Allison V–1710 C15 Engines — 25c
Operation and Maintenance Handbook for Allison V–1710–F2, 3, 5's, 10's 20 and 21 — 75c
Allison Commercial Parts Catalog for Models V–1710–F5R and F5L Engines — 25c
Allison Commercial Parts Catalog for Models V–1710–F4 and 10 — 25c
Pilots Handbook for Operation and Maintenance of Allison V–1710–F3R Engines — 25c
Pilots Handbook for Operation and Maintenance of Allison V–1710–F5R and F5L Engines and V–1710–F10R and F10L Engines — 25c
Operation and Maintenance Handbook for Allison V–1710–E–4, 6, 18 and 19 Type Engines — 75c
Allison Commercial Parts Catalog for V–1710–E4 Engines — 25c
Allison Commercial Parts Catalog for V–1710–E6, 18 and 19 Type Engines — 25c
Pilots Handbook for Operation and Maintenance of Allison V–1710–E4 Engines — 25c
Commercial Overhaul and Service Tool Catalog for Allison Engines — 25c
Operators Manual for Allison Engine Installations — 40c
Pilots Notes for Allison Engine Installations — 25c

Note: Allison visual aids available at above prices to Government Agencies, Contract Schools, and Authorized Training Agencies.

American Automobile Association, Traffic Engineering and Safety Dept., Washington 6, D. C.
(The following items should be obtained from local AAA Motor Clubs if possible.)
Teachers Manual, Wartime Driving — 32c each
Sportsmanlike Driving Textbook — $1.25
The Driver — 12c
Driver and Pedestrian Responsibilities — 12c
Sound Driving Practices — 12c
Society's Responsibilities — 12c
How to Drive — 12c
Driver Education and Training Manual for High School Teachers — 25c
Standardized Tests for Sportsmanlike Driving — $1 per 100
Road Test in Traffic — 3c per set
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Driver Testing Devices
Plans for Building Driver Tests — 25c
Bicycle Skill Tests
Instructor's Guidebook for Training Drivers for Emergency Driving (in mimeographed form)
3 Driver Education Posters — 3c each

Association of American Railroads, Transportation Bldg., Washington 6, D. C.
Yearbook of Railroad Information
The Day of Two Noons
Quis
Railroad Histories and Sources
List of Principal Railroads in the U. S.
The Human Side of Railroading
A Review of Railway Operations
Statistics of Railways
Growth of Railway Mileage in the U. S.
Railroads in Two Wars
Mars Rides the Rails
Pioneers in Transportation
The Iron Horse Delivers the Tools of War
Railway Literature
Railroads at Work
American Railroads and the War
Performing in War and Preparing for Peace
Land Grants
Getting Over the Hump
The Railroads of Tomorrow
How America's Freight Is Moved in Wartime (circular)
Restaurants on Wheels (mimeographed)
Dining Car War Magic (mimeographed)
Casey Jones at War (mimeographed)
Outline of a Study Course in Railroad Organization, Operation and Traffic (mimeographed)
Suggested Works for a Study of Railway Traffic and Transportation (mimeographed)
Opportunities for Women in the Railway Industry in Peace and War (mimeographed)
Growth of the United States of America During First Century of Railway Era (Compiled from U. S. Government Reports)

The Atchison, Topeka and Santa Fe Railway System, Public Relations Department, 80 East Jackson Blvd., Chicago, Ill.
(Address requests directly to Mr. Lee Lyles, Assistant to President, Santa Fe Railway, 1404 Railway Exchange, Chicago 4, Ill.)
Conquest
The Railroad
Meat for America's Millions
Delicious Foods in Tin and Glass
The Railroad at War
The Railroad

Bendix Aviation Corp., Fisher Building, Detroit, Mich.
1944 Edition of the Bendix Invisible Crew (limited stock on hand)

Braniff Airways, Love Field, Dallas, Tex.
Southwestern Hospitality on Wings
Something About Braniff Airways
The B Liner (monthly publication)
Super B Liner in Flight (photograph)

Civil Aeronautics Administration, Pre-Flight Aeronautics Program, Washington, D. C.
Education for the Air Age
World Maps for the Air Age
CAA Bulletin No. 32, Fundamentals of Elementary Flight Maneuvers
A Syllabus for a Collegiate Course in Aviation for Elementary Teachers
A Course in the Science of Aeronautics for Secondary School Teachers
Announcement of Examinations on Aeronautical Knowledge for High School Students

Delta Air Corp., General Offices, Municipal Airport, Atlanta, Ga.
Delta's Role in the War Effort
Agents Who Put the Passengers and Cargo Aboard
Delta Air Lines (history)
Delta Routes Are Rich in Historical Background
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What Does It Take to Be an Airline Pilot?
Airline Reservations Department Requires Careful Procedures
Timetables
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(Above material available to teachers only; limit — two copies per person.)

Fairchild Aircraft, Division of Fairchild Engine and Airplane Corp., Hagerstown, Md.
(Attention: James A. Wales, Jr.)
Set of Color Prints of Popular Airplanes — 8 by 11 sheets (one set to instructors or schools)

Fletcher Aircraft, 625 North San Fernando Road, Burbank, Calif.
Standard Aircraft Workers' Manual — $1.50

General Motors Corp., 3044 West Grand Blvd., Detroit 2, Mich.
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Three Speed Gear Transmission (chart)
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From Iron Ore to the Finished Automobile (chart)
Four Stroke Cycle and Flame Travel (chart)
Engine Efficiency (chart)
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Metallurgy and Wheels
When the Wheels Revolve
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Diesel, the Modern Power
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Research Looks to New Horizons
Transportation Progress
We Drivers
The Three R's of General Motors Training
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Power Primer
(Above booklets and charts available in limited quantities only.)

The Goodyear Tire & Rubber Co., Akron, Ohio
Story of the Airship — $1
Materials in a Goodyear Tire (display) — $2

James Jackson Cabot Professorship of Air Traffic Regulations and Air Transportation Publications, Norwich University, Northfield, Vt.
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The Early History of Air Transportation — 50c
Technical Development and Its Effect on Air Transportation — 50c
Safety in the Operation of Air Transportation — 50c
European Air Transport on the Eve of War — 1939 — 50c
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K–D Manufacturing Co., 526 N. Plum St., Lancaster, Pa.
Valve Service Bulletin No. 542

Kendall Refining Co., Bradford, Pa.
Passenger Cars and Their Lubrication — Bulletin 14
The Lubrications of Truck and Bus Transmissions — Bulletin 15
Lubrication of Truck and Bus Rear Axles — Bulletin 16
The Tractor and Its Lubrication — Bulletin 17
Diesel Engines and Their Lubrication — Bulletin 19
Lubricant Recommendations for Industrial and Marine Engines — Bulletin 20
Refining Process Bulletin

Kinner Motors, Inc., 635 West Colorado Blvd., Glendale, Calif.
Kinner B5, B5R Series 2 and B 54 Engines
Kinner Aircraft Engines
The Kinner Family
Service Tools for Kinner Engines
Kinner R–5 Series 2, R–55 and R–53 Engines
Kinner R–56 Engine
Kinner R–5–1, R–5 Series 2, R–53 and R–55 Parts List
Brochures Covering All Models of Kinner Engines (Spanish, English, and Portuguese)
Service Bulletins for Kinner Engines

Link Aviation Devices, Inc., Binghamton, New York
Link Bubble Sextant — Model A–12
Link Instrument Flying Trainer
Link Star Globe
Link Collimator

Mid-Continent Airlines, Inc., Fairfax Bldg., Kansas City, Mo.
Little Known Facts About the Scheduled Air Transport Industry

National Carbon Co., Inc., 30 East 42nd St., New York 17, N. Y.
The Inside Story of Dry Batteries
Automotive Cooling System Standard Practice Instructions (chart)
Cooling System
"Eveready" Manual of Cooling System Service
(Above literature available in very limited quantities only.)

Official Aviation Guide Co., Inc., 608 S. Dearborn St., Chicago, Ill.
Official Guide of the Airways (monthly) — Single copies, 50c; $5 a year
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Pan American Airways System, 135 East 42nd St., New York 17, N. Y.
Pan American World Airways has available for free distribution for educational purposes copies of speeches of vital interest to those who are concerned with the subject of aviation, miniature dictionaries in Spanish-English and Portuguese-English, maps showing the extent of Pan American World Airways before Pearl Harbor, and some articles dealing with sections of the world in which there are Pan American operations. Among those are Wake Island and a number of countries in South America. An article on Guam is in preparation.

Pennsylvania-Central Airline Corp., Washington National Airport, Washington, D. C.
Know Your Company — booklet (available only to teachers and libraries)
Little Known Facts About Scheduled Air Transportation
Timetable

Pennsylvania Grade Crude Oil Association, Oil City, Pa.
How Pennsylvania Motor Oil Is Made — $1 per hundred
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Complete Teacher's Kit — $1

Pratt & Whitney Aircraft, East Hartford, Conn.
Pratt & Whitney Aircraft Series C Twin Wasp (chart)

Socony-Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Petroleum and the Petroleum Industry

Transcontinental & Western Air, Inc., Kansas City, Mo.
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An Educational Guide in Air Transportation

U. S. Office of Education, Federal Security Agency, Washington 25, D. C.
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Aircraft Sheet Metal, Preliminary Course — No. 1081 — $1.35**
Aircraft Sheet Metal Work–Layout–Preliminary Course — Bulletin No. 104 — $1.25**
Aircraft Welding, Preliminary Course — Bulletin No. 109 — $1.20**

United Air Lines, Dept. of School & College Service, Palmer House, Room 305, Chicago 3, Ill.
Story of United Air Lines
Teacher's Kits for (1) grades 1–3, (2) 4–6, and (3) junior-senior high school — 25c each

*Order from New York State Education Department, 40 Howard St., Albany 7, N. Y.
**Order from Utah State Board for Vocational Education, Division of Industrial Education, State Capitol Bldg., Salt Lake City, Utah.

Four-page and 6-page leaflet on the naming, location, and use of the parts of a main liner plane
Timetable
Menu Cards
Aircraft Identification Chart
Chart of Mainliner Parts (picture)
Airlines of the United States (map)
Free and Inexpensive Materials Directory

The Waco Aircraft Company, Troy, Ohio
The Waco Word (monthly magazine)

Joseph Weidenhoff, Inc., 4340–58 Roosevelt Road, Chicago 24, Ill.
Handbook of Engine Maintenance
Battery Charging
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Automotive Electrical Systems and Engine Performance
Generators and Starting Motors
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Willard Storage Battery Co., 246 E. 131st St., Cleveland, Ohio
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Willard General Catalog Technical Supplement
(Sample copies of this material available at no charge. Additional copies may be had at 10c each.)

Wright Aeronautical Corp., Division of Curtiss-Wright Corp., Paterson 3, N. J.
Wright Cyclones (brochure)
ABC of the Cyclone Engine (leaflet)
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Guide to Wright Powered Military and Naval Aircraft (leaflet)
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Price List of Wright Technical Publications
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Power House of Aviation (booklet)
History of Wright Aeronautical Corporation (booklet)

(To be continued)

Safety Provisions and Regulations for School Shops

*Joseph Murri**

It is the responsibility of every school administrator, teacher, and especially the shop teacher, to have learners work in safety. Accidents are not only caused by human behavior termed *carelessness*, but also by an unsafe environment. Provisions should be made in planning school shops and in existing shops which will eliminate or greatly minimize causes for accidents. Human behavior can be regulated by proper instruction and vigilance on the part of the instructor. Safety rules and regulations should be learned and practiced by the learners, not only to safeguard them in the shop, but for developing the right kind of *safety attitude* and habits in our future workers.

Safety Provisions

The planner of the school shop, besides following the local building code, should observe the following safety precautions:

1. All exit doors should swing out.
2. Large shops should have at least two exit doors.
3. Window sill height should be no less than 40 in.
4. Provide proper heating and ventilation.
5. Have only approved electric wiring and controls.
6. Order only substantial and safe machinery and equipment.
7. Have proper spacing between benches, machinery, and equipment, usually not less than 4 ft.
8. See that aisle space is ample, usually not less than 4 ft.
9. Provide proper illumination.
10. See that workbenches are placed correctly with reference to light.
11. Locate fire extinguishers in appropriate places.
12. Install a first-aid cabinet.

*Edward Bok Vocational School, and George C. Thomas Junior High School, Philadelphia, Pa.

Safe Electric Wiring and Equipment

All new wiring should be installed in rigid conduit (on surface or concealed); connections to motors may be made with short lengths of flexible conduit. Motors, switching, and starting equipment, should be properly encased and grounded. Electrical installations should be according to the "National Electrical Code," or the local code.

Switchboards in electrical shops should be of the *dead front* type (no exposed live parts). Where the older *open fronts* are present, a rubber mat or its equivalent and a guard rail should be installed. Power breakers should be operated only by the instructor or under his immediate supervision.

Storage battery rooms should be properly ventilated; and all switches, ventilating equipment, and electric lamps in these rooms should be of the vapor proof type.

Protection of main and branch circuits should be by individual circuit breakers instead of fuses. In old installations where fuses are used, wires or substitute fuses should not be allowed in fuse boxes; and all test lamps should be of the 220-volt type in keyless insulated sockets.

Safe Machinery

In the installation of new equipment, only individual motor driven units should be used. Where the older types of long power belt transmission equipment is in use, they should be carefully guarded, with guards of expanded metal or of wire screen of ¾-in. or similar mesh and at least No. 14 gauge wire.

Moving parts of all machinery such as gears, pulleys, belts, clutches, projecting moving parts, and the like, should be guarded with guards constructed of expanded metal, perforated metal, or wire screen of ½-in. or similar mesh and at least as heavy as No. 18 gauge wire.

It is advisable to paint the contact parts of a machine (work parts) with a light gray, or any other color that will give a contrast with the body of the machine.

Control switches should be on every machine, and mounted in such a position as to be readily accessible to the operator.

Proper Illumination

Good illumination, both natural and artificial, will produce less eyestrain, greater cleanliness, better workmanship, and cheerful surroundings. The area of the source of natural illumination should not be less than 16 per cent of the floor area.[1] In planning a new shop, it is desirable to have windows on the long side of the room and extending to the ceiling. Benches, machinery, and equipment should be so arranged as to have an even distribution of light with no shadows. The ceiling and walls should be of a light color — preferably white.

Artificial illumination by the use of filament type bulbs or fluorescent lamps should be from the ceiling, thereby eliminating individual lighting of machines and equipment. With the filament type bulbs, indirect or semiindirect luminaries should be used. While standards of 8 to 15 foot-candles (at the work surface) have been used as the minimum, the following levels of illumination are recommended:[2]

Shops (general work)	30 f.c.
Shops (close work)	100 f.c.
Sewing rooms	100 f.c.
Drawing and drafting rooms	50 f.c.
Laboratories (general work)	30 f.c.
Laboratories (close work) .	50 f.c.
Corridors and stairways ...	5 f.c.

[1] *The School Plant — Bulletin No. 86*, Pennsylvania Dept. of Public Instruction (1939), p. 40.
[2] Sturrock, Walter, "Recommended Levels of Illumination," *Magazine of Light*, No. 6, 1941.

Class and study rooms .... 30 f.c.
Lecture rooms (general) .. 20 f.c.

The amount of illumination in foot-candles (used interchangeably with lumens per square foot) can readily be measured with small pocket type foot-candle meters. These meters can be purchased from electrical supply houses or from manufacturers of electrical meters and instruments.

Safety Regulations

Proper Instruction and Supervision. Before allowing a learner to work with tools or machinery, the instructor should explain and show the proper method. When learners are not feeling well, or are emotionally upset, they should not be allowed to work, especially with machinery. Informational material consisting of posters, film slides, and demonstrations should be used frequently.

A student shop safety organization consisting of the instructor, shop foreman, toolroom man, and a safety engineer or safety inspector should be formed. The members of the committee should always be changing in order to develop the *safety attitude* in the entire class. The committee should offer suggestions for methods of preventing accidents in the shop. A list of specific safety rules should be composed for each shop. The safety inspector or engineer should see that the safety rules are observed:

When working with machinery and furnaces, the following rules should be observed:

1. Neckties are to be tucked in.
2. Sleeves are to be rolled up.
3. Goggles must be worn at the grinder or molten metal furnace.
4. Furnaces must be lit by the properly authorized person, and all flames must be kept inside.
5. All horseplay must be avoided.
6. Remove no safety guards from machines.
7. Leave no hot metal pieces lying about unprotected.
8. Avoid letting machines run while the operator is away.
9. Avoid using rags around machines that are running.
10. All work on drill press must be held in vise or clamp.
11. Permit only one worker at a time at the grinders.
12. All machines are to be released before thowing on power switch.

Proper Type and Use of Hand Tools

Tools should be made of good material, and each one should be appropriate for the particular use. Those not in use should be stored safely on racks, shelves, boxes, or placed on appropriate boards. Tools with defects, such as mushroom heads on cold chisels and hammers, splintered hammer handles, chipped hammer heads, splintered ax or sledge handles, loose heads of hammers and axes, and dull cutting tools, should be removed from services as soon as they become defective.

Knives and sharp cutting tools should be equipped with a hand guard, such as a disk, or an equivalent, which will prevent the hand from slipping against the blade. Knives and sharp cutting tools should be carried around only in devices affording protection, such as sheaths.

Precautions should be taken to avoid tools falling from ladders, scaffolds, balconies, and the like. Tools should not be left lying around on floors, stairways, or passageways. Careful adherence should be made to the following list:

1. Screw drivers should not be used as chisels.
2. Screw drivers should be shaped properly to fit screwheads.
3. Adjustable wrenches should always be turned in the proper direction.
4. Pliers should not be used in place of wrenches.
5. Carpenters' hammers and machinists' hammers should not be interchanged in use.
6. Cutting pliers should never be used on live wires regardless of whether they are taped or not.
7. Lead, copper, or rawhide hammers should be used on tempered tools and fixtures, to prevent flying chips of hard steel.
8. Tongs or special holders should be used when holding bull chisels.
9. Wrenches should not be used as chisels.
10. All files should have handles.

Good Housekeeping

Neatness and good work habits should be developed by the learners. The following are recommendations for good housekeeping.

1. Work spaces should be kept clean and orderly.
2. Floors should be kept clear of obstruction and free from oil and water.
3. Tools should not be left on floors, moving parts of machinery, ladders, or elevations.
4. Spaces under benches, stairways, closets, and similar spaces should be kept free of refuse of all kinds.
5. Bottles, papers, and rubbish should not be left lying around.
6. Oily rags, waste, and the like, should be kept in covered metal containers.
7. Nails should be removed from boards even when stored.
8. Materials should be piled so as not to create a hazard.
9. Materials should not be left in aisles or in entrances.
10. Proper ventilation should always be had to prevent accumulation of fumes, gases, or dust.

Proper Handling of Chemicals

Recommendations for handling and storing chemicals applicable to shops and laboratories:

1. Inflammable liquids such as gasoline, naphtha, benzine, benzol, toluol, xylol, amyl acetate (banana oil), carbon disulphide, alcohols, ethers and acetones, should be kept in metal safety cans in quantities of not over five gallons.
2. Possession of matches or other flame producing articles should be prohibited in areas where inflammable materials are used or stored.
3. Soldering fluxes and acids should not be allowed to get into eyes or on clothing.
4. Never pour water into strong sulphuric acid in order to dilute it. But pour the acid slowly into the water while stirring.
5. Wear rubber gloves when working around battery acid.
6. Allow plenty of room around experiments that might be dangerous.
7. Always use a laboratory apron or coat when working with chemicals.
8. Never put back any chemicals into stock bottles unless told to do so specifically by the instructor.
9. When heating chemicals in test tubes, always have their openings toward the sink and away from all persons.
10. Do not drink or taste any chemicals unless specifically told to do so by the instructor.

Fire Protection

Shops and laboratories should be provided with adequate and approved fire extinguishing appliances conveniently located and conspicuously marked. Learners should be instructed as to the use of fire fighting equipment and procedures.

Extinguishing a Clothing Fire

Should a person's clothing catch on fire, a large coat or blanket should be wrapped around him and he should be slowly rolled on the floor. If nothing is available, the person should be rolled slowly on the floor. If water is available, it should be poured on the person, and he should be rolled in the water that has fallen to the floor.

Instructional Use of Fire Extinguishers

Electrical equipment fires should be extinguished with the vaporizing nonconducting liquid type, such as a pyrene extinguisher, or the carbon dioxide type. Soda-acid and foamite fire extinguishers should never be used on electrical equipment because of danger of electrical shock to the user. Buckets of sand may also be used on electrical equipment fires.

To Operate a Pyrene Extinguisher (1 quart size with carbon tetrachloride). Grasp the extinguisher and give the handle a slight turn to right or left, after arriving at the scene of the fire, squirt the liquid at the base of the fire by a pumping action. CAUTION — DO NOT BREATHE THE FUMES AS THEY ARE POISONOUS.

To Operate a Soda-acid Fire Extinguisher: Hold the nozzle with one hand and upset the extinguisher with the other; keep the nozzle aimed at the base of the fire — one charge will last about one minute.

The extinguisher contains bicarbonate of soda and sulphuric acid, in separate cups, and water in the container. When the extinguisher is upset, the chemicals mix and an extinguishing spray results. Because of this, the extinguisher should not be upset until the fire is reached.

To Operate a Foamite Fire Extinguisher: The operating instructions are the same as for the soda-acid type.

The extinguisher contains aluminum sulphate, bicarbonate of soda, and a foam agent, all in separate cups. They must not be mixed until the fire is reached.

First Aid

First-Aid Equipment: Every shop should have a first-aid cabinet. This should be placed in an easily accessible place and have a red cross painted on it. The first-aid cabinet should be equipped with the following:

Instruments — a pair of scissors, thumb forceps, tourniquet, eye cup.

Drugs: 2 oz. — aromatic spirits of ammonia, 2 oz. — 4 per cent aqueous solution of boric acid, 2 oz. — 2 per cent tincture of iodine, 4 oz. — 2 per cent mercurochrome, 1 jar of white vaseline.

Dressings: 1 package of picric acid gauze (for burns), 1 roll of adhesive plaster ½ in. wide, 1 roll of adhesive plaster 1 in. wide, 1 package of absorbent cotton, 1 roll of 2-in. sterile gauze, 4 rolls of 1-in. sterile gauze.

First-Aid Instruction: The entire class should receive first-aid instructions. It should be remembered that regardless of how trivial an injury may appear, first aid should be administered immediately. First aid is only an emergency treatment — until a physician can be summoned. The instructor or shop foreman should administer first aid. If the school building has a nurse, the injured may be referred to her immediately, if not, the injured should be treated by a first aider and where the injury is severe, the patient should be removed to a hospital as quickly as possible.

Accident Records

It is good practice to keep a detailed record of every accident case. The instructor should provide mimeographed or hectographed forms that should be used whenever necessary. When an injury requires a physician, a detailed report must be made to the school principal for use by the school district.

The keeping of records offers an excellent opportunity for the study of accident causes and preventions and it is only because of this that great strides have been made in reducing the number of shop accidents. These records should be filed away so that they may be used as evidence if the need arises later on.

Operating the Wood Jointer Safely

*Richard M. Bell**

Lesson No. 1

Purpose: To inform the machine operator of the common causes of accidents in the operation of the jointer, so that he may guard himself and others against them.

Content: The common causes of accidents to a jointer operator are:

1. Attempting to joint stock shorter than 10 in. invites injury, as the stock tends to tip up and throw the fingers into the knives.

2. Attempting to joint stock shorter than 15 in. without using a push block to hold stock parallel with the tables at all times.

3. Talking, or glancing away from work, or day dreaming while machine is running.

4. Attempting heavy cuts, ¼ in. and up, to save time, may cause injury or waste of material.

5. Making any adjustments while the machine is running. First turn off electricity and then wait for knives to stop rotating.

6. Running machine without a guard when it is possible to use one.

7. Feeling of knives or turning them by hand may lead to serious and painful cuts.

8. Starting the machine before:

a) examining wood for metal, loose knots or parts.

b) Getting permission.

c) Examining table for depth of cut.

d) Examining guard to see if it is in working order and in position.

e) Making necessary adjustments for your particular job.

f) Testing all adjusting screws and nuts to make certain they are tight.

g) Cleaning safety lanes of people and material.

9. Passage of all traffic should be carefully watched to see that:

a) They remain outside of safety lanes.

b) The operator is not molested, bumped, or interfered with in any way to distract him from his job.

*Leonia, N. J.

Lesson No. 2

Purpose: To learn how to operate and adjust a jointer for ordinary work.

Procedure: Know information contained in Lesson No. 1 on the jointer.

Information: The jointer is a machine that does the same kind of work that a hand plane will do. The size of the machine is listed as the length of the cutting knives which limits the machine to boards of that width or less. Our jointer is an 8-in. size. The cutter head is a steel cylindrical shaft in which are fastened three steel knives. These knives are sharpened like plane irons with a bevel on only one side. This cylinder turns around about 4200 times in one minute. It turns toward the board and operator and cuts in the opposite direction to which the board is being pushed.

The cylindrical cutter head is driven directly from the motor and rotates between two adjustable tables. The front or in-feed table and the back or out-feed table. These tables are adjusted by hand wheels. The out-feed table is kept level with the cutting edges of the knives while the in-feed table is adjusted to the depth of the cut desired by the operator before turning on the motor. After the tables are adjusted by the hand wheels, they are locked in position by hand screws.

The fence is fastened to an arm which slides on the motor shell and may be adjusted for any width board up to 8 in. It is held in the desired place by a handled bolt on the top of the slide. The fence may be tilted backward to an angle of 45 deg. from the vertical. It is then locked in the desired position by a nut located at the back of the machine.

The guard must be used at all times when the nature of the work permits. It should only be removed to do rabbeting and this only by special permission.

Use: The jointer is used to plane surfaces and edges of wood to be sawed on the variety saw. It is also used to plane edges in preparation for gluing. The machine may be used for chamfering or beveling at any angle and for rabbeting if the operator is very careful.

You, as a student, should not adjust the rear table as this is the instructor's duty. You may adjust the front table for the depth of the cut you wish to make always bearing in mind that two thin cuts will leave a better surface than one heavy cut.

Get personal instruction on this machine from the instructor.

Reference: See page 39 of *Principles of Woodworking*, Herman Hjorth, published by The Bruce Publishing Co., Milwaukee 1, Wis.

Jointer Test

In order to be eligible to operate the jointer you must know the answers to the following questions. Complete the meanings by filling in statements after the letters.

1. Traffic must be careful to: (*a*) ..... (*b*) ..... (*c*) .....
2. Before starting the jointer do the following: (*a*) ..... (*b*) ..... (*c*) ..... (*d*) ..... (*e*) .....

In the places provided, place an *R* if you think that the statement is right, and a *W* if you think the statement is wrong.

1. .... Talking to the operator of the jointer is not allowed.
2. .... The cutter head holds four steel knives.
3. .... Work shorter than 10 in. long may be jointed on this machine.
4. .... Chamfering may be done on this machine.
5. .... Set the machine for ⅛-in. cuts on all work.

6. .... The fence may be tilted to 90 deg.
7. .... You must use a push block on all short work from 10 to 15 in.
8. .... You should adjust the rear table.
9. .... Start the machine, then make the fence adjustments.
10. .... The cutter knives are sharpened on both sides.
11. .... Keep the guard in place over the knives at all times.
12. .... This machine will plane up to 10 in. in width.
13. .... Keep your fingers away from the knives.
14. .... The cylinder turns counter clockwise toward the front table.
15. .... Check all fences and tables before starting the machine.
16. .... Special permission is necessary before rabbeting.
17. .... Check the guard to see that it is in working order.
18. .... Keep eyes and mind on your work while machine is running.

Education Offered by the U. S. Indian Service

*Willard W. Beatty**

The United States Indian Service operates 42 high schools, 39 in the continental United States and 3 in Alaska. The great majority of Indians are rural dwellers and the land areas still in Indian ownership are primarily useful for stock raising, agriculture, or lumbering. The vocational work in the greater number of Indian Service high schools in the United States is therefore pointed toward more effective use of Indian resources and happier rural living.

Eight of the larger secondary boarding schools are located in or near cities at some distance removed from the Indian country and many of the students who elect to attend these schools do so in order to obtain the vocational training which will equip them for urban employment. However, a continuing study of postgraduation employment shows that a great many of these students eventually go back to make their homes on the land. Therefore in many of these schools, the years frequently referred to as prevocational in the average public high school are devoted to certain basic courses which are preparatory to successful rural living.

Rural High Schools

Our rural high schools are usually located in areas where almost the whole population is Indian. These are usually 12-grade schools. Because of the wide distribution of Indian population, many of the high school children board at the school — as is true of the white children in the rural areas of the same states. These facts create problems which are very different from those of the average rural day school. The great majority of Indian Service high schools are fortunately situated with regard to campus reserves. When the sites were originally chosen these schools were so remote that they had to produce their own milk, meat, and vegetables. Therefore it is not unusual for a school to have an adjacent farm area of from a thousand to eight or ten thousand acres.

*Director of Education, Office of Indian Affairs, Chicago, Ill.

While many of the southwestern tribes originally farmed on a small scale and had even developed systems of gravity irrigation, the northern tribes lived largely by hunting and fishing. The advent of the white man has almost completely destroyed the wild game, with the result that it has been necessary for these Indians to learn entirely new ways of making a living from the lands remaining under their control. For the Plains Indians in the Dakotas and Montana the transition from buffalo hunting to cattle raising was relatively simple and would probably have been successfully accomplished had an attempt not been made to introduce farming instead, during the agricultural boom in the Plains states. This excursion into agriculture was effectively blocked during the great drought. Since then the effort of the schools and the Extension Division of the Indian Service has been to encourage Indian use of their resources for livestock raising.

The Elementary Schools

The elementary schools of the Indian Service also emphasize living with the land and with livestock. In most day schools and boarding schools the children of the different grades have gardens and care for livestock of various types. It is nothing unusual for a class group to raise its own cow, to care for a litter of hogs, several sheep, a couple of milk goats, or a small flock of poultry. It is hoped through these experiences to develop in the children a familiarity with the love of the land and the products of the land. There is considerable evidence that this program is successful in achieving its purpose.

Under the administrative regulations of the Indian Service it is possible for children to earn the ownership of young livestock or to share in the proceeds of the farms or gardens for which they are responsible. Thus a youngster can begin to acquire livestock early in his school course and keep on accumulating until his graduation from high school. This livestock can be maintained on the school lands, provided the youngster earns the equivalent of the grazing fee, or can be taken home and merged with the parents' stock. After graduation a youngster may obtain additional livestock on what is termed a repayment basis — that is, he agrees when he receives a heifer calf to repay the school with the first female issue.

A few years ago most Indian Service high schools, as was true with most vocational schools outside of the Indian Service, operated "finding courses" in the late junior high or early senior high school years. Children were enrolled first in one shop and then in another for six-week intervals, with a view to finding out what the work was like. For the final two or three years they were encouraged to select and concentrate in one or two shops until graduation, thus becoming skilled in one or more vocations. More recently, some of the schools have substituted for the finding courses, general shop courses of two or three varieties. One of these may be in the field of trade training, where experience is provided in all of the skilled trades to the extent that would be useful in rural life. The pupil learns through experience to pour concrete for foundations, for a hog wallow, or for a drinking trough; carpentry through building a chicken house, a small barn, or some other structure; plumbing to the extent of running water into such a structure. He then may wire it for electricity, paint it, install mill work, building a brick chimney. He digs post holes and erects a fence, and has other similar experience, all closely related to the demands which are likely to occur on a ranch or farm. A second year may be devoted to a similar series of general shop experiences in the mechanical trades. The pupil learns how to shoe a horse, repair the tire on a wagon, weld a broken axle, maintain an automobile, repair and maintain a gasoline engine or a simple Diesel engine on a tractor, truck, or piece of road equipment, mend farm machinery, sharpen a plow, rewind an electric motor and similarly master the various problems encountered on the farm and ranch.

Gardening and Care of Livestock

The third year if the pupil is enrolled in an urban boarding high school he may have some limited experience in gardening and in the care of livestock if his final vocational training is to take the form of specializing in the building trades or a mechanical trade. If attending a reservation high school, and it is likely that he

will remain on the reservation as a cattleman or farmer, the last two years are given over to an intensive instructional program with either agriculture or livestock. In either case, the course continues throughout a twelve-month period, for most of the major learning with either agriculture or livestock inevitably occur during the summer months when the academic school is closed. If the youngster enrolls in the cattle program, in many of our schools he may be on the range with the cattle, caring for his own string of cattle horses, preparing his own meals, mending fences, repairing winter shelters, etc., for intervals of six weeks which alternate with six weeks of academic instruction back at the school. During the summer he will take active part in the roundup and the branding, castrating, inoculating, and dehorning of the cattle. During the year he will be responsible for cutting and stacking wild hay for winter feed, and for raising any additional feed which may be necessary to carry the cattle through the winter months. He will have experience in stock judging and sometime during the course will probably visit one of the larger stock shows of the Plains area. He will have experience with butchering, cutting up meat, preparing hides for sale, and with various forms of salting, smoking, or brining meat for its preservation.

During his senior year he will become a member of a junior cattle association in which he will have experience in the maintenance and the sale of cattle, looking forward to ultimately becoming a member of an adult cattle association after graduation from school. The extra work involved in the care of livestock over week ends and through vacation periods is credited toward the ultimate acquisition of animals of his own, and the harder he works the more livestock he may eventually possess.

If he is interested in farming, after a year of general participation in the school farm or garden, the student may be assigned the use of a block of land which he will farm or garden by himself or in association with one or two other boys under a contract arrangement with the school, whereby the student receives the profit from the project after paying rent to the school for the land, machinery and equipment, and repaying the loan for the seed and fertilizer he may have used. Any crops which he raises may be fed to his own livestock or may be sold on the open market or to the school. Depending upon the boy's interests he may have one or more seasons of this kind of experience, using his profits to build up a savings fund with which to finance himself after his graduation. Agreements of this kind usually provide that about 30 per cent of the proceeds may be used by the student immediately for his own purposes, but he is encouraged to retain the remainder on deposit.

Vocational Education

Where a student majors in automobile mechanics, carpentry, plumbing, welding, or printing, the preliminary courses are becoming more general so that a youngster may learn through experience the interrelationship between the various crafts. In the later years, emphasis is continuously placed upon actual experience in doing under practical conditions the things that the youngster will be expected to do after graduation.

Throughout the vocational work there is close correlation between the knowledge needed in the shops or on the farm, and the related courses taught in the academic departments. Every effort is made to expose the student to the demands that will be made upon him if he is called upon to make a living with any of these skills after graduation.

During the period of depression our schools naturally had as much difficulty as schools elsewhere in the country in placing any reasonable proportion of graduating classes when their work was completed. Postgraduate opportunity was therefore provided for full-time vocational experience, and youngsters were invited to return to school and were permitted to devote full time to practical work in the field of their major vocation without academic classes. The school contributed toward the placement of these students by keeping potential employers aware that youngsters of exceptional skill were available for immediate employment, at any time during the school year. The great majority of students who returned for the full-time vocational instruction secured employment before the year was out. In the same way full-time postgraduate opportunities with agriculture or cattle raising were offered in a number of our schools. A student who had completed the high school course was permitted to return the year following and under share-crop contract with the school obtain land and equipment to carry on a practical program in a specialized field, such as the raising of potatoes, green beans, wheat, poultry, or beef cattle. During this postgraduate period the student was free from academic requirements and in a position to devote his entire time to the perfecting of his vocational skills.

Educating the Indian Girl

Our records show that the great majority of Indian girls marry or become homemakers shortly after graduation from our high schools. The major emphasis in their vocational instruction therefore is in child care and homemaking. In the reservation schools, this is supplemented by work with gardens and with the smaller livestock, such as poultry, milk goats, or hogs. In many rural areas, if there is to be a home garden and if there are to be opportunities for fresh eggs, milk, and varieties of meat the activities which produced these must be carried on by the women.

Training which will enable the girl to increase the cash income of the family is also offered through the adaptation of native Indian crafts to the demands of the white market. Emphasis is therefore placed in many Indian schools on work with rawhide or buckskin, the application of bead embroidery or porcupine quill embroidery to skins, weaving, pottery making, or basketry in areas where each has been traditional. However, there are large numbers of Indians whose traditional tribal crafts have been discarded for many years, yet the people retain a high degree of manual dexterity. Indian schools therefore have introduced loom weaving, pottery making (using modern oil-fired kilns instead of the dung fire of the primitive craft) and other home crafts.

Indian girls are also prepared for commercial work, for beauty culture, for commercial cookery, and other similar skills, or they receive preparation for advanced training as nurses, teachers, and a variety of other professions. Many Indian students come from homes which have not yet adapted to modern ways of making a living and which are therefore poor in worldly goods. The schools must therefore teach new skills by which they can earn a living after graduation.

To increase the number of Indians who advance in the professions there is a federal loan fund to finance collegiate or advanced vocational training for Indian high school graduates. While the curriculum of the Indian service high schools is not primarily college preparatory in type, the opportunity is given for Indian students who wish to proceed to advanced work to transfer to schools which offer the specific matriculation requirements for colleges to which they aspire. For the past decade about the same proportion of Indian high school graduates have gone to college as has been found true of American public school graduates in general.

Industrial-arts courses in order to be of optimum benefit to the prospective inductee should (1) emphasize skill and the use of hand tools, (2) develop foundational skill in a variety of occupational areas so as to permit flexibility of assignment, (3) emphasize thoroughness and accuracy, (4) be related to military situations, (5) develop leadership qualities. — *Major Ralph C. Wenrich*, Chief, Preinduction Training Section, Office of the Director of Military Training, Headquarters, Army Service Forces, Washington, D. C.

If education fails to learn a lesson from the Army and Navy in cutting the nonessentials in preparation for employment, it will have missed one of the greatest education lessons in war. — *C. M. Miller.*

Since we have been able to find jobs for everyone in producing the materials of war, we ought to be smart enough to find jobs for everyone in producing the materials and providing the services needed in an economy of peace. Unemployment is the cancer of high-energy societies. If our democratic way of life is to continue, we must find a permanent way to full employment; we must give citizens an opportunity to perform worth-while, significant work, so that they will feel they have a definite part in the shaping and rebuilding of a more effective way of life. — *R. H. Woods.*

The Place of the Armed Forces in Conversion Training*

*Lt. Col. Verne C. Fryklund***

All military training is conversion training. At the Armored Force School at Ft. Knox, and at other training schools of the armed forces the training takes the form of conversion from peace time to war.

The army does not give any training, occupational or otherwise, to prepare the soldier to return to civilian life.

Of course, much of the training that was given in technical work in the army is going to put many a man in a new civilian occupation when he returns. But *that* training was incidental. He was actually being readied for combat.

If a fellow changes his occupation from clerking in a dime store before the war, to a radio mechanic immediately after the war, it is because he had the chance, the instruction and the will to learn and succeed in the training given him in preparation for combat. He is fortunate. War did something for him. But we trained him for war.

Many a young man will change his occupation because of such experience. It is only in that manner that the armed forces have indulged in "Conversion Training" for civilian life. The armed forces do not intentionally train for civilian work.

There is a qualification, however. When the shooting stops in Europe and the men are to be returned home, there will not be transportation facilities available to return them all at once. There are so many troops that a long time will pass before all are returned. While biding time, every man waiting his turn will have an opportunity to go to school. He will have an opportunity to go either to a school and take training of his choice, or continue with military training.

Those of you who were overseas in the last war can well guess what the choice will be. It won't be close order drill for most of them.

The soldier overseas can go to a European University or to a technical school if he so desires. Every possible form of education will be provided so long as there are enough persons interested to start a class. It may be calculus or dairy husbandry, bookkeeping or piano playing. Anyway, he can have it, whatever it is, a start or a continuance of his education — or close order drill.

My present military assignment as Officer in Charge of the Educational Activities in the Convalescent Hospitals of the Army Air Forces Personnel Distribution Command places me in a service that must inevitably follow the misfortunes of war. My efforts at Ft. Knox were in the nature of make-ready for the fighting in the Armored Force. Now my assignment is in the Air Forces. I am assisting in the program that schoolmen refer to as *rehabilitation*. But *our* conception of rehabilitation is quite unlike the usual schoolman's conception of that term. *Our* major mission is rehabilitation of health rather than rehabilitation of occupation. Occupational rehabilitation is considered primarily a function of the Veteran's Administration — a job to be done when the man leaves his uniform, and war, behind. The men are *returning* from the war *now*. Those who are incapacitated are arriving home. Those who are in good health are returning to the continent on a rotation basis.

When the men return from overseas, they are given physical examinations. Many are temporarily or permanently disabled. They are started on the road to recovery according to the extent of their disability. There comes a time in the mending process when the patient has time on his hands; he leaves his bed and can walk, yet he is not ready for return to duty or for return to civilian life. He is convalescing. When time gets heavy and lags he gets his mind on his troubles or on his memories. This may undo all that has been done for him by the physician. Interesting work at this stage becomes good medicine. It keeps the mind off worry and, as everyone knows, worry is usually disastrous if indulged too much. It will even ruin the health of a well person.

The men want purposeful and interesting activity. Many of them want to do more than the bedside craftwork of the kind that was prevalent in the base hospitals of the last war — a few *busy work* activities. When a man is recovered to a point when he can wear his uniform again, every possible type of educational activity is provided for him from which to choose. We offer all kinds of shop and academic activities, farm, music, sports, and so on. He *must* spend three hours per day in some form of educational work and two hours per day in physical reconditioning.

These three hours per day of purposeful activity are prescribed for him by the physician. It is part of his medicine. It is a must. He may choose the activity but once he has started his educational work, he must continue; unless, of course, it is decided that the work he chooses is too strenuous for him. He may be assigned to lighter work, and so on. Or, perhaps he has limited joint action from injury and must have work that will "team" with the physical therapy department. He is assigned to some type of work that will give purposeful exercise, interesting exercise to the muscles in question. Of course, I must not leave the thought with you that *physical* therapy is the *main* objective. Merely getting the mind on interesting work, creating something from materials, is mighty fine medicine, even for people who never have been injured but who are fatigued from the routine of the work they are accustomed to do. That is why some of *us* have shops or laboratories at home. But there also are other avenues of interest that are helpful.

Not long ago at an Air Force Hospital in California, 17 enlisted men were graduated from the local city high school. They had finished their interrupted high school education while convalescing in the base hospital. These boys might have been doing other things less purposeful. It is quite certain that they mended faster, and they got their diplomas in the process.

One young PFC finishing a baby bed. He was convalescing at one of our hospitals. He was mending, for sure. He was quite proud to tell that he was going to be a father and was sending that bed home, and no doubt, the home folks were thrilled, too. That fellow was getting some really good medicine in doing such work.

A young flying officer was sewing together some leather parts on a foot-powered sewing machine. He chose leatherworking because he liked to fashion useful and artistic articles out of plain pieces of leather. He had limited knee action because of a combat injury. The physician had prescribed physical therapy which was administered in the Therapy Department, and the pedal action of the sewing machine in the leathercraft shop provided supplementary exercise in an exceedingly interesting way. The young man is a lawyer in civilian life. He will probably not ask for G.I. retraining assistance, but it is almost certain that he will have a craft shop in his home.

Many more instances of such vocational and avocational training in our convalescent hospitals could be cited. None of them are intended for occupational preparation, however. All are provided to help the physician in his efforts to help the patient help himself to get well. If the patient learns, as in the California hospital, where the 17 men were graduated from high school, we like it also, just as did the parents of those boys to whom their work had a very special meaning of worth.

These boys have given all but their lives in a war and now they are home again. We owe them much. To expedite their recovery then, we are trying to give them a start toward "conversion training" as

*Address given at the American Vocational Association Convention at Philadelphia, Pa., Dec. 7, 1944, 2:00 p.m.

**Officer in charge of Educational Activities in the Convalescent Hospitals of the Army Air Forces, Headquarters, Army Air Forces Personnel Distribution Command, Atlantic City, N. J.

part of the medicine prescribed to make them well.

Now for a description of our educational layout. We have shops of all kinds: machine shops, woodworking shops, electrical and radio shops, craft shops, drafting and art rooms, print shops, and so on. They are set up as general shops. For example, our machine shop is actually a *general* machine shop and includes in addition to the usual machine-shop equipment, limited facilities for welding, sheet-metal working, forging, and plumbing. With this equipment the patient can work in most materials except wood. Besides metal he can work in plastics, do metal spinning, make art metal projects, do strap iron work, work on models, and so on, in addition to the wide variety of things he could do in a machine shop alone.

One of our hospitals includes farm facilities in which to raise pigs and cows. A professional horticulturist and the necessary greenhouse is to be found in another hospital. In another hospital patients are learning to raise vegetables and plants without soil.

There is music of all kinds in the hospitals. Music, as is well known, is sweet medicine. It is a necessary part of everyone's daily experience.

All kinds of academic offerings are available to the convalescent soldier. If he really wants to study such a seemingly *dull* subject as algebra while he is convalescing, we will provide the teacher and the time and the place. United States Armed Forces Institute courses are available to him, too. As you may know these courses are, for the most part, self instructive and require only occasional supervision. One third of the attendance is in academic work.

You may be questioning how we get our shop equipment. Through surplus. When the training of the technicians for combat began to decrease, shop equipments were no longer needed in the amounts we had on hand. In order to expedite the recovery of our convalescent soldier we have been given the use of some of these excess equipments. If they were offered for sale on the market, the return would not be high. But the return is high — doubly high — if it is used in aiding in the recovery process. After we are through using it for that purpose, it can be sold at a price probably no less than it would command before such use.

We secure our supplies in the same manner. Both equipment and supplies are on hand — their cost is not added to the tax burden. The equipment and supplies are available and vocational education procedures are performing a new role. The Air Forces Medical Staff utilizes them to help our soldiers get well.

The question may be asked "How do we get our instructors?" We get them from among ourselves, from the personnel of the military forces. In fact, we even find many patients who derive therapeutic value from teaching. On the whole, men who have returned from combat are the teachers. We are not employing civilians at present, nor are we offering commissions. Thus far, it is an "inside" job.

As already stated, the armed forces are not in the business of vocational training, but we are not running our educational activities on a puttering basis either. The men are taught how to perform the shop operations properly. But if patient *A* seems not to profit from the instruction, practically, and yet he gets well again, we feel that we have scored just as much a success as with patient *B* who learns a lot and gets well also.

The criterion of completion is recovery rather than amount of learning. If we have a patient in the machine shop long enough so that he has learned a few operations on the lathe while making something, and the physician says that he has recovered, we no longer keep him. He returns to duty or goes to civilian life.

If he returns to duty he may change his work and one of the Armed Forces Technical Schools provides the necessary training. If he is returned to civilian life, he is given several days of instruction — orientation we call it — on the civilian socio-economic situation as it is now, and he also is told of his rights under the G.I. Bill.

The armed forces are giving rehabilitation training to the men while in uniform, but it is rehabilitation for recovery, not rehabilitation for occupational service. It isn't training, per se. But we feel satisfied and so does the soldier if he learns while recovering his health, and especially when learning contributes to that recovery.

What Industry Expects of Vocational Education*

*S. Lewis Land***

Industry expects vocational education to assist in (1) reducing the time required to adapt workers to production, (2) securing the maximum utilization of available man power, (3) reducing the amount of time spent by foremen and supervisors in breaking in "green workers" on jobs, (4) reducing to a minimum the use of plant production equipment for training, (5) reducing to a minimum the loss of materials and machines due to breakage and poor workmanship, (6) reduction of labor turnover, and (7) the reduction of absenteeism.

While studying what industry expects of vocational education it also may be well to study what vocational education has done for industry. A survey of 90 war-production plants in New York State, served by The New York State Program of Vocational Training for War Production Workers provides a fine testimony given by the war industry in New York State, on each of the eight points listed in the foregoing.

1. *Time required to adapt workers to production.* Plant officials were requested to furnish a record of the average time required to bring "green help" up to acceptable production standards (*a*) prior to organized training, and (*b*) with organized training. The reports indicate that an average of 4.05 months were required to bring new workers up to acceptable production standards without prior training, as compared with an average of 1.83 months with organized training. This shows that training produced an actual saving of 2.22 months' time, amounting to 55 per cent.

2. *Maximum utilization of available man power.* For the past 3 years, many sections of our country where there is a concentration of war production have experienced serious labor shortages. Even today the War Manpower Commission lists 68 such centers as critical labor shortage areas. In these areas the supply of skilled labor to meet the needs resulting from expansion in the war-production program has necessarily had to come in large part from those already employed. These employed persons have naturally had to be trained in supplementary classes. Over 4,100,000 such persons have been trained since the beginning of the program on July 1, 1944.

Plant officials were requested to furnish information concerning the number of training hours saved through this process of "upgrading" workers to provide maximum utilization of available man power. They reported that the upgrading process produced an average saving of 214.17 hours per trainee.

3. *Saving of supervisory time.* As the war-production program has grown and expanded, and the number of war-production workers has increased, it has been necessary to increase the number of persons employed in managerial and supervisory capacities. This need has been met in industry through both the training and employment of additional supervisors and through the reorganization of the work of the foreman and supervisor to enable him to spend a maximum amount of his time on production work. The training of workers in school shops rather than in the production plant has been an important factor in this connection.

*Abstract of an address before the Practical Arts and Vocational Education Section of The Pennsylvania State Education Association, December 28, 1944.

**Head, Department of Industrial Education, The Pennsylvania State College, State College, Pa.

Plant officials were requested to estimate the time devoted to training and "breaking in" green workers by foremen and supervisors (*a*) before use of organized training methods, and (*b*) after use of organized training methods. They report that foremen and supervisors were spending 41.3 per cent of their time in training and "breaking in" green help, and that after use of organized training methods an average of 14.3 per cent of their time was spent in "breaking in" green help; a saving of 27 per cent of supervisory time. The time which has been saved has, of course, been allocated to other important responsibilities in increasing war production.

4. *Minimum use of production machines for training.* Many new production plants have been constructed during the period of the past four years. It has, of course, been necessary to equip, as well as to man, these new plants. There has been a shortage of machine tool equipment, and accordingly it has been important to utilize all existing equipment in plants for production and to have training done in schools already equipped to do the work.

Plant officials were requested to estimate the number of production machine hours saved per trainee through the use of school facilities for training. They report that an average of 661.3 production machine hours were saved per trainee through the use of the vocational training program for war-production workers.

5. *Saving material.* Separate estimates of loss of materials and machines as a result of breakage and poor workmanship for (*a*) the entire personnel, and (*b*) for trained workers, were requested. Plant officials submitted information indicating that there was a 9.5 per cent loss in materials and machines traceable to poor workmanship for the entire personnel, contrasted with a 2.5 per cent loss for trained workers, or a reduction of 7 per cent after training. This means an actual 73 per cent reduction in spoilage through organized training.

6. *Accident reduction.* The accident rate for the entire personnel, and the accident rate for trained workers were requested. The average accident rate for the entire personnel for these plants is 8.2 per cent as compared to an average accident rate for trained workers of 2.9 per cent, or a reduction of 5.3 per cent. This means an actual 65 per cent accident reduction among pretrained workers.

7. *Labor turnover.* The rate of turnover for the entire personnel, and the rate of turnover for trained workers were requested. The average turnover for the entire personnel as reported by these plants is 32.01 per cent as compared with an average turnover for trained workers of 16.75 per cent, or a reduction in labor turnover with trained workers of 15.26 per cent. This means an actual 47 per cent reduction in labor turnover among pretrained workers.

8. *Absenteeism.* The percentage of absenteeism involving (*a*) entire personnel, and (*b*) trained workers, were requested. These plants report an absentee record of 6.61 per cent for the entire personnel as contrasted with an absentee record of 4.1 per cent for trained workers, or a reduction of 2.51 per cent after training. This means an actual 38 per cent reduction in absenteeism among pretrained workers.

These are some of the specific contributions which vocational education has made to the war-production program and to industry generally.

What is industry going to expect of vocational education in the days ahead when we shall be converting from war production to peacetime activities? Our problems in the future will be no less important but more complex. We shall need to give to industry the same kind of cooperation in the reconstruction period as in the war period.

To express it in more general terms, we shall need to provide assistance to industry in these three areas:

1. *Expansion of opportunities for vocational training.* At present most medium sized and large communities are maintaining adequate programs for training in the skilled fields. We shall need to expand this program both downward and upward to provide training opportunities for the semiskilled occupations on the one hand and to provide training opportunities on the vocational-technical level on the other hand. We shall need to expand our programs to provide training opportunities for youth in the smaller communities where previously no such opportunities have been available. This may be done both through expansion of existing programs and through the establishment of area vocational schools.

2. *The retraining of warworkers for peacetime activities.* When industry reconverts from war production to peacetime activity many workers will already possess the necessary skill to make the shift without additional training. Many thousands of workers, however, will need to be retrained for the new work in which they will be engaged. Industry will expect our cooperation in providing opportunities for this retraining.

3. *The education and training of demobilized service personnel.* When the war ends and the enlisted personnel returns to civilian employment, many men and women will be able to return to old jobs without additional training. A survey of the 700 enlisted men from one county made recently, however, revealed the fact that 62 per cent of the group did not desire to return to the job they left but plan to change to some other field. Some men in this group have received training while in the armed forces to enable them to begin employment in the new field of work. Many others will need retraining, or at least supplementary training, for the new occupation they have chosen. Over and above all, there is the fact that many thousands have physical disabilities, which are service corrected, which make necessary a change in employment. Most of these will require rehabilitation training. Industry is, of course, going to look to vocational education to do this very important job of rehabilitating the returning serviceman so he may again enter industry.

Vocational Aspects of Air Craft Production*

*Charles R. Beck***

Aviation is more than dramatic flight across wide oceans — more than bombers and pursuit planes in raids and battles — more even than regularly scheduled flights in luxury liners carrying passengers and mail. Aviation is a business, and in recent years, big business.

The reader may get some idea of the growth of this business in recent years, from the following data. The number of people employed in aircraft manufacturing during the past five years shows an enormous increase.

1939	49,000
1941	390,000
1942	640,000
1943	1,200,000

There has been on an average of 287,750 new people enter the field each year. Last year alone 560,000 people entered the field of aircraft work for the first time. The industry has risen from a very insignificant beginning to one of the largest of all industries today.

Aeronautical Engineering

It might rightfully be asked, "just what are all these new people doing in aircraft work? What type of work are they engaged in?" By far the large majority of these people are engaged in the actual production of the airplane. There are five different phases of this production work that a person might enter. One of these phases is that of aircraft engineering. To get into this field today, special training in aeronautical engineering is usually necessary. We might break this engineering field down into different types of work. First, is that of aircraft designing. Those who have had a flare or interest in mechanical drawing might have a particular aptitude

*Address given to the high school students at Evansville, Ind.

**General Superintendent, Thunderbolt Plant, Republic Aviation Corp., Indiana Division, Evansville, Ind.

for aircraft designing. In this work, general knowledge of all phases of aircraft engineering is necessary, but the primary concern of the designer is to design a plane to do a specified job, keeping in mind such things as the speed that must be attained, the load the plane must carry, and the distance it must be able to fly. An example of the work of a design engineer, is that of Mr. Kartveli, the designer of the P-47 Thunderbolt.

In 1940, General Arnold, Chief of the Air Forces, returned from witnessing the "battle for Britain." He was convinced that our fighter planes were not suitable for high-speed, high-altitude warfare. It was then that he called Mr. Kartveli and asked him to design a high-speed, high-altitude, fighter plane which would be something much better than the Axis could possibly produce for some years to come.

The story is often told of how Mr. Kartveli sketched out the basic design for the Thunderbolt on the back of an old envelope in General Arnold's office. Seven months later, Thunderbolts were rolling off the production lines. This is an engineering and production accomplishment of which every American can well be proud.

There are others who have a special interest in such subjects as physics. These might be interested in another type of aircraft engineering — that of a stress engineer. It is his job to design the various parts of a plane to be strong enough to carry safely the load demanded of them and yet light enough to insure good flight qualities.

Associating himself and tying in very closely with the stress engineer is the weight distribution engineer. He must concern himself, not only with keeping the over-all weight to a minimum, but also with how this weight is distributed. Weight distribution affects the flying qualities or maneuverability of the plane.

Those who are interested in seeing plans put into operation — who have a flair for engineering — may be interested in the last and final type of engineering — production engineering. This is a fairly recent addition to the engineering department. It is the production engineer's job to modify the original design so that it can be produced most efficiently in production and still serve the purpose for which it was originally designed. For instance, it is his job to see that the shop can produce the plane with the least number of actual work hours and it is also his job to see that parts are made accessible for servicing.

In an engineering department of an aircraft plant, all of these various types of engineers are working together. Their activities must, of course, be co-ordinated and in a sense, one type of engineer acts as a check upon the other. The work of an aircraft engineer is highly interesting. To prepare for it, technical training in some good aeronautical engineering school is necessary. To do well in aeronautical engineering, a person should have a liking for or be somewhat proficient in mathematics, physics, and mechanical drawing.

The second major phase of aircraft work lies in the field of tool engineering. A person entering this field might be employed in any of several different capacities. One type of work is that found in a lofting department. Lofting is the layout of the lines of a ship, full size, on an inferior grade of metal, known as gray plate. From these layouts are made the tools that will be needed, to form and shape the parts.

Another type of work done in the tool design department is that of template making. Templates are steel plates which have been cut to the dimensions indicated on the lofting drawings for the purpose of making and checking parts. Holes are usually drilled in these which act as a guide, so to speak, for the drilling of holes in the actual part to be manufactured.

Still another type of work in tool engineering is that of the building of jigs and fixtures, which will hold the parts while they are being drilled and assembled. Tool engineering also entails the making of dies. This work is usually done in the tool shop or the foundry. People engaged in this type of work are usually tool and diemakers. They, as a rule, begin as tool-maker apprentices in machine shops and gain experience and technical knowledge as they go along. In the course of three or four years, they are usually fully qualified as journeymen tool and diemakers. This type of work involves the laying out of certain jobs. Here, some algebra and trigonometry are brought into play, as well as the knowledge of the operation of power machines, such as the turret lathes, milling machines, grinders, and the like. This type of work usually pays well and tool and diemakers are in great demand.

Another major phase of aircraft work is that of production planning. In this type of work, it is a function to set up the work so that it progresses from one step to another in a sequence that produces the greatest efficiency. This includes determining the types of tools necessary and the planning of the sequence of operations, so that a part passes from its beginning until it is finished with the least expenditure of time, money, and effort. It is also a function of this department to determine the number of people needed to do each phase of work and to set up standard times within which the operation should be completed. With this done, a special department under planning, usually called production control can arrange for the materials to be on hand at the particular time and place needed. This enables the company to know exactly how long it is going to take to make up each part and to do each operation in the manufacture of a plane; hence, exact production schedules may be set up, and it is possible to determine the number of planes that can be turned out in a specified time. In fact, it is possible with this knowledge to predict within five minutes when a particular plane is going to roll out of the final assembly door — a finished product.

The Manufacturing Phase

The phase of aircraft work that absorbs more people each year than any other phase is that of manufacturing. This work is done in what is commonly referred to as the shop. The shop does not start a job until a shop work order from the planning department has been obtained. This shop order states the materials to be used, the particular departments to do the work, and the sequence of operations to be performed.

Due to specialization, there are many different departments in a shop. Typical of the various departments are those of material preparation, machine shop, processing, primary assembly, general utility, fuselage, and final assembly.

When material for machined parts first comes to raw stores, after having been properly inspected, it would go to the machine shop where it might be sent to a milling machine, turret lathe, drill press, or whatever other machine can best do the operation stipulated on the work order.

If it is sheet stock, it would usually go to the material preparation department, where it will be cut to size on power shears and formed on either power brakes, hydraulic presses, mechanical presses or drop hammers. This department is equipped with massive machinery, heavier than that in any other department. Typical of this machinery is that of the large hydraulic press. The press, itself, stands about 25 feet above the ground with its base 8 to 10 feet below the ground. The press is approximately 12 feet in diameter at the base. One of the presses has a revolving head padded with a 5 or 6-in. rubber blanket. This head can exert a 2500-ton pressure, hence the rubber blanket forms the sheet material around whatever form block it may be placed upon. In order to keep this press in operation at all times, there are six tables, equally placed around the base, and one operator can slide his table under the head while the other operators are placing the material on top of their particular forms. Each of these tables is operated by a button which is pushed when the operator has prepared his table for the press and it will automatically slide underneath it when clear.

The mechanical press differs from the hydaulic press in that the length of the stroke is regulated or set by the operator. These are used more for blanking and piercing materials. In this operation, one can cut materials to the exact size needed and also pierce all holes in the same operation. Materials are often taken from these presses to the hydraulic presses where they are formed. From the material preparation department, materials would ordinarily go to the process department — that is, after inspection. Here materials are hardened, plated, anodized, or painted, whatever is necessary, depending upon how the part is to be used and on the type of material that it is. Most material used in a plane is an alloy of aluminum called dural. This is usually formed in the material preparation shop in what is known as softened, or SO state. In the processing department, this material is changed into the hardened, or ST state. This is done by putting the

aluminum pieces, after they have been formed, into large ovens where they are heated to approximately 930 degrees for about 30 minutes. With a minimum loss of time, these pieces are then quenched in cold water and left to age for approximately 10 hours. After this aging, they are then in the hardened, or ST state.

Besides work of this type, the processing department does plating and anodizing. Cadmium plating is performed on steels and anodizing on aluminum alloys. Both of these processes are designed to arrest corrosion. In anodizing, the materials are immersed in a tank containing a chemical solution through which an electric current passes which tends to oxidize or corrode the surface to form the protective covering.

Another type of work done in the processing department is that of painting materials. Most of this work is done with spray guns. Many of the operations in the processing department involve electrolysis or chemistry, hence, they are interesting to those who have a scientific bent of mind.

Parts leaving the processing department are inspected and from there they usually go to primary assembly, which might be described as the early stages in the formulation of the finished product. It is in this department that the plane begins to take shape.

These small assemblies are then transferred to the fuselage department where they are assembled and the skin, or outer surface of the plane, is put on and here, of course, the actual fuselage of the plane is built.

Fuselages then move on to the final assembly department, where the wings, engines, landing gear, and other instruments and fixtures are installed.

The general utility shop of a plant is charged with the responsibility of reworking parts which have been made in error or damaged in other shops of the plant and parts that have been subsequently changed and can be modified to incorporate the change.

The fifth major phase of aircraft work is that of inspection. There are a number of different types of inspection work. One of these is that of tool inspection. To be a good tool inspector, a man should have some engineering knowledge and should be a practical mechanic. Another type of inspection work is that of detail part inspection. Here a knowledge of blueprint reading, and the use of precision measuring instruments is primarily needed. Such instruments as micrometers, calipers, height gauges, and others are used extensively in this work.

Another type of work in this field is that of the inspection of raw materials. Here, all materials that enter the plant must be inspected to determine whether or not certain standards and specifications are being met. If the materials are faulty it could cause a part failure and possible loss of a pilot or a plane. In the inspection laboratory, the grains of certain metals are studied through the use of X-ray equipment, chemical analysis, and microscopic study.

Still another phase of inspection work comes in inspecting the finished product. Here the inspector examines the product for workmanship, being sure that it is safe, clean, and constructed according to specifications that are required. He must also see that all parts function properly and that all clearances are correct.

Now, the last phase of this work is that of preflight inspection. In this type of work, the inspector checks the engine, the instruments, the landing gear, the radio and those things that deal primarily with the safety of the airplane. As the name implies, this is done just before the plane is ready for its initial flight.

In any type of inspection work, a little engineering knowledge would be helpful. Before rising very far in the field, practical knowledge would have to be gained. The main thing, above all others, that an inspector needs to have and use is good judgment and good common sense.

Opportunities for Advancement

If a person comes into a job in the manufacturing department as an ordinary helper, he can, by paying attention to his work and by being on the job every day, gradually work himself up to the point where he is a mechanic. The possibilities from there are unlimited and depend entirely upon his own initiative. From a mechanic, a person can come up to be a group foreman and then a foreman. He can then advance to be a supervisor and then a sectional supervisor of a department in the aircraft industry. Then, as the old saying goes "by keeping his nose to the grindstone" and minding his own business, he can come on up the ladder to be superintendent, factory manager, or what have you.

This takes a lot of hard work and long hours, but it is something that can be done as there are unlimited opportunities in the aircraft field. It depends entirely upon the individual.

To give some idea as to the complexity of a higher supervisory job, it may be well to describe the work of a general plant superintendent. It is his job to see that some 22,000 parts get themselves together in the right order and come out a Thunderbolt. That is to correlate and co-ordinate the seven production shops that comprise both the parts plant and the assembly plant, day and night shifts, and that means about everything that actually goes into a Thunderbolt, except the pilot. Everything — from the time it begins as raw bar stock and sheet metal at one end of the plant, picking up subassemblies along the line, going through the various stages of processing and assembling, until the finished P-47 rolls through the huge doors at the end of the plant onto the hangar apron. Solving this complicated puzzle is really a big problem. The many necessary operations in this product require the ingenuity and skill of all departments functioning together as one. It is the general superintendent's job to see that the departments are cooperating properly and that the operations dovetail in producing the required work in a specified time.

If there is a shortage of certain materials, it is necessary to get them through, working with production control. This division lists what particular requirements are critical, where they are needed and then supplies them. You can see that to do anything of this nature, one has to begin at the bottom and work up, so that he is acquainted with all phases of the work in the manufacture of an airplane.

Since our entry into the war, we have taken people from all walks of life and molded them into an organizational structure which today has one of the top efficiency ratings of the nation. Many of these people had no special training or inclination for this type of work, but have progressed very rapidly in the industry because of their interest and their willingness to work.

We are reaching in the aircraft industry a degree of specialization whereby a person does not have to know the over-all picture as would have been necessary years ago. It is only necessary for him to know his own particular job. This, of course, decreases the length of special training time which one would need to get into the field. In fact, a boy or girl can walk out of the school a graduate today, and become engaged in some field of aircraft work tomorrow.

There are two ways to gain knowledge in preparation for work in an aircraft industry. One is to gain a fundamental, theoretical knowledge in some aeronautical engineering school. The other is to get right into the industry and gain a practical knowledge by working in a plant. If one had to choose between one or the other, probably the practical knowledge would be preferable, but the ideal combination for the beginner is to get a fundamental, theoretical knowledge, and then realize that he does not know all the answers and combine this with a practical knowledge in the plant. This combination is hard to beat. It is said that theoretically the bumblebee cannot fly, but just because he can't read blueprints and doesn't know anything about aerodynamics, he goes ahead and flies.

The best advice to the beginner is to get all the technical training he can in schools. But he should realize fully that this is not the complete picture and that to it he must add the training which he can only get through actual work in the industry.

Today, as we go along, we have a greater wealth of information from which to draw. This was not always the case. In fact, up until the present time, we have been gradually in the process of shattering theories by practical experience. A typical example of this was that only a few years ago, according to a theory, a propeller, after reaching a certain size and pitch, reached its maximum efficiency. Today, we know, from actual experience, that propellers of

far greater diameter have actually proved themselves in practice. Also, a few years ago, theoretically, a plane could not go over 500 miles an hour, yet today with the Thunderbolt diving in excess of 800 miles an hour, we hesitate to guess at what top speed a plane may eventually fly.

Incidentally, you might be interested in knowing that the pilot who first dove his plane in excess of 800 miles an hour did it by pure accident. It was not his intention to do so. He simply could not pull the plane out of its dive. Finally, he struck upon the idea of using his trim tabs, which, fortunately, did the trick. It is told that after his plane came out of its dive, his only comment was "Thanks Lord, I'll take over now."

At the present time we now have the jet-propulsion motors which apparently have great promise. This is probably one of the greatest single developments to have come out of this war. This is due to the fact that we have possibly reached the peak of efficiency in the present type of propeller-driven planes.

There is a need, in aircraft work, at the present time, for supervisory personnel — people who can take responsibility. There is a need for this type of person and we do not have a sufficient supply from which to draw. One reason is that most people in aircraft work have not had sufficient experience. We must use people now who have had but a year's experience along these lines.

Because of the war, production had to get under way, and an industrial miracle had to be performed. General Arnold takes his hat off to the aircraft industry who were producing 117 planes in September, 1939, and expanded that into one that produced 7598 in September of 1943, 8800 in November, 1943, and expects to produce 145,000 within the next 15 months. We are told that right now, there is, in all theaters of war, a need for double the number of planes they already have.

The aircraft industry is not just a wartime baby, for there is promise of a glorious future for it after the war. Mr. Charles I. Stanton, Administrator of Civil Aeronautics in this country, has this to say:

"There is going to be a phenomenal growth in private flying — as phenomenal as the growth in automobiling after the last war. Every thoughtful man has long been aware of the profound influence which the motorcar has had upon every part of America and every phase of our lives — upon all our institutions, traditional points of view, modes of recreation, business habits, industrial technology, marketing practices, city planning — and the general pattern of living. The airplane is likely to have a similar influence. It will intensify some of our present problems and create new ones of its own. These problems will not automatically solve themselves. They can be solved only by clear foresight and intelligent anticipation of the difficulties to be met and overcome.

"Second, commercial air transport will continue to grow steadily. Between 1937 and 1942 the number of passengers riding the air lines increased from 8700 to more than 4,000,000 a year. In the same period, air mail jumped from 1,270,000 to 44-, 600,000 pounds annually, and air express and freight from 46,000 to 22,300,000 pounds. Remarkable as it is, this rate of growth will, most likely, be considerably accelerated during the next decade."

In so far as salaries in the industry are concerned, they compare favorably with other industries and it pays back dividends in a job well done. Working conditions are safer and cleaner than in practically any other industry that might be mentioned. This industry will have a profound effect upon the history of the world, and it will spread civilization to the four corners of the globe and help bring them closer together.

INDUSTRIAL-ARTS EQUIPMENT AND SUPPLIES FOR THE GENERAL SHOP

JEROME LEAVITT
Verona, N. J.

Equipment and Tools

This alphabetical list may be helpful in setting up a new shop, checking inventories, or preparing lists of items to be included in the budget.

Alcohol torch (small)
Anvil — 100 lb.
Aprons, heavy, with bib, one for each member of the class
Asbestos metal heating screen for use in science work
Ash cans, large size with lids for waste materials
Awls — brad, assorted sizes
Backsaw, Disston No. 4
Ball-peen hammer, 8 oz.
Barometer tube
Bar magnets
Bending fork set
Bells
Bench stops, one for each vise
Bits
- *a*) Auger, 3/16 to 1 in. inclusive, by 16ths.
- *b*) Auger, 3/16 to ½ in. inclusive, by 16ths.
- *c*) Countersink, for wood, rose pattern, ½ and ⅝ in.
- *d*) Dowel, square shank, ¼, 5/16, ⅜, ½, and ¾ in.
- *e*) Expansive, ⅞, to 1½ in.
- *f*) Expansive, ⅞ to 3 in.
- *g*) Forstner, square shank, ¼ to ½ in. inclusive by 16ths.
- *j*) Screw driver, square shank, ¼, 5/16, and ⅜ in.
- *k*) Twist drill for wood, square shank, 1/16 to ⅜ in. inclusive by 16ths.
- *l*) Twist drill, straight shank, 1/16 to ⅜ in. inclusive, by 32nds.

Bit extensions
Bit gauge, Stanley No. 49
Blackboard compass
Block plane, No. 118 "boy-proof" Stanley
Block plane irons, extra blades, for block plane Stanley No. 118
Blow pipe
Bone folders
Bottles — to be used as containers, quarts — pints and gallons
Braces, ratchet type 8-, 10-, 12-, or 14-inch sweep
Brooms
Brushes, all sizes
Bunsen Burner
Butter mold
Bulletin board, slate or composition
Burnishers
Buzzers
Cabinet scraper
Cabinet, divided into sections for storing work and materials
Cans, all sizes
Candle mold
Carders for wool and cotton
Carpenters' horses
Casting bench and equipment
Carborundum stones
Center punch
Chairs, teachers
Chisels
- *a*) Wood, ⅛, ¼, 5/16, ⅜, ½, ¾, and 1 in.
- *b*) Cold, ¼, 5/16, ⅜, and ½ in.

Clamp
- Wooden
- *C* clamp 6 in.
- Bar clamp 4 in.

Clothes wringer
Counter sinks
Cornering tools, assorted sizes ⅛ to ½ in.
Compass
Coping saw
Cross-peen hammer, 8 oz.
Crosscut saws
- *a*) Crosscut Disston 24 in., 7 points
- *b*) Rip Disston 24 in., 7 points

Culture dishes with covers
Die stock
Dies, assorted sizes
Dividers — 6 in.
Double convex lenses
Dowel sharpener, to correspond to dowels used
Drafting tables or benches
Drawknife 8 or 10 in.
Drawing boards
Drill, small electric
Dust pans
Electric bench
Electric motor for grinder
Etching needles, electric
Eye shield for use in grinding
Eyelet setters
Evaporating dish, porcelain
File card and brush, Disston
Files
- *a*) Half-round cabinet wood file
- *b*) Half-round cabinet rasp
- *c*) Saw files
- *d*) Round files
- *e*) Square files
- *f*) Mill file, second cut
- *g*) Needle files

Filing cabinet
First-aid cabinet and supplies
Flask
French chasing hammer, Dixon
Galvanized iron, sheets
Gas lighter, flint
Gas range or gas furnace
Glass cutters, Red Devil
Glass cylinder, large
Glass funnel
Glass — rod
Glass tubing
Goggles
Graduals
Hack saw blades, Starret 10 in., 24 tooth
Hack saw frames, Millers Falls No. 99
Hammer handles, assorted sizes
Hand drill, Stanley No. 617
Hand brushes, for brushing off benches
Hooks for hooking rugs
Horseshoe magnets
Jack plane, Millers Falls No. 11
Jars, all sizes
Jewelers' saw frames

Keyhole saw
Knives
Ladle
Lathes, small bench with motor
Levels
Lockers
Looms
Mallets, wooden
Marking gauges, polished boxwood
Masons trowels
Metalworking vises
Metalworking benches
Meter stick
Microscope, small
Miter box saws for Stanley No. 2244 miter box
Miter boxes Stanley No. 2244
Nail hammer, bell face with curved claw, Standard No. 102½, 10 oz.
Nail sets
Oil cans
Oil stones
Oil waste cans
Pencil sharpeners
Pliers
a) Combination
b) Electricians'
c) Round nose
Plummers scraper
Polishing head
Protractors
Push buttons
Push pull ruler
Putty knives
Rivets sets
Rubber rod
Rulers, one foot
Sandpaper, Behr-Manning No. 00, 0, ½, 1, 1½
Saw set
Saw vise
Scissors
Screw-driver bits
Screw drivers, assorted sizes
Shuttles 10 in.
Silversmith hammer
Sink with hot and cold running water
Smooth plane, Millers Falls No. 8
Snap button outfit
Soldering coppers — one pound
Sprayer — paint
Spring punches
Stake set for metalworking
Star drill
Steel squares
Stilson wrench, small
Stools
Straight peen hammer
Straight wrenches, one set
Tables
Tack hammer
Tap wrench
Tape, assorted sizes
T Bevel
Telegraph
a) Key
b) Sounder
Test tubes
Test tube rack
Tin snips, 8 in.
Tool panel
Transformers
Triangles, celluloid
a) 45 deg.
b) 30 — 60 deg.
Tripod
Trowel, masons pointing
Try squares, 8 or 10 in.
Turning saw frames, 18 in.
Turning saw blades, for 18-in. frames
Twist drills, high speed, assorted sizes
Wheel dresser
Wood scraper extra blades
Wood scrapers
Woodworking benches
Woodworking vises, screw type, double jaws
Woodworking benches, double with hardwood top
Wrenches
a) Adjustable, 8 and 10 in.
b) Pipe, 8 and 12 in.
c) Tap, adjustable, various sizes
Yardstick

Supplies

Acetone
Alcohol
Aluminum, (*a*) sheets, (*b*) bars, (*c*) tubes, (*d*) angles
Ammonium chloride
Anodes, copper
Asphaltum
Ash
Basswood
Battery, dry cell
Beaver board
Black iron, sheets
Blotters
Blueprint paper, medium speed, light weight
Brass, (*a*) sheet, (*b*) tube, (*c*) bars
Burlap, for use in weaving
Buttons
Candle wicking
Cardboard
Cards
Carpet tacks, assorted
Casco glue
Casein
Celluloid
Cement, Portland
Chemicals
Chestnut
Clay
Cloth, variety including unbleached muslin
Common nails, all sizes
Copper, sheet
Cotton, demonstration set
Crack filler
Cypress
Double pointed tacks
Dowels, 1/16, ⅛, ¼, ½, ¾, and 1 in.
Elastics
Electric wire for lamps
Emery cloth, No. 00, 0, ½, and 1
Enamel, red, orange, yellow, green, blue, black, and white
End papers
Envelopes
Erasers
a) Rubber
b)Sponge
Escutcheon pins, brass ¼ in.
Fiber board
Finishing nails, all sizes
Fish paper
Flathead screws, all sizes
Formaldehyde
Friction tape ½ in.
Gimp, black and white
Glaze, variety of colors
Glazer points
Gloves, rubber
Glue chips, animal
Glycerine
Hasp for cabinets
Hinges
Hydrochloric acid
Ink remover
Ink, writing and India
Iron, band and angle, assorted sizes
Iron sulphate
Kerosene
Key plates, for leatherwork
Labels
Lacquer, all colors and clear
Lead
Leather
Liquid solder
Liver of sulphur
Linseed oil
Lye
Metal foil, copper and brass
Mending tape
Motor oil
Muslin
Neats foot oil
Needles
Nickel silver, sheets
Nitric acid
Notebooks
Oak
Oil
Oilcloth
Oil stain
Paste
Paper, for sketching
Pins
Plastics in sheets and rods
Plastic wood
Plastic wood solvent
Plywood, fir
Pulleys
Raffia
Rags, for cleaning purposes
Reed
Rope
Reinforcements
Rivets,
a) Roundhead iron, all sizes
b) Flathead tinners, all sizes
Rouge
Roundhead screws, all sizes
Rubber bands
Rubber experimental kit
Rubber stoppers with holes
Rubber tubing
Running thread
Sal ammoniac
Save-a-brush
Screw eyes, small brass
Shellac (*a*) white, (*b*) orange
Soldering paste
Snap buttons
Solder, spool
Sponge
Spongex
Spruce
Stain — oil (*a*) walnut, (*b*) mahogany, (*c*) maple
Steel wool No. 0 and 1
String, white
Super
Tacks, carpet
Tar paper
Tin, sheet
Thread (*a*) black, (*b*) white
Tongue depressors
Tracing paper
Tripoli
Turpentine
Twine, heavy
Varnish
Vellium, various colors
Water stain
Wax, paste
Wedges, assorted
White lead
White pine
Wire (*a*) iron, (*b*) copper
Wool, demonstration kit
Yellow pine
Zinc, sheet

Business comes only from a standard of living. There is absolutely no other source. This is why the church and the school have done more than any other institution to promote business. The higher the standards are, the better business will be. — *Dr. R. L. Cooley.*

WHAT ARE THE DESIGN ELEMENTS IN LETTERS?

1. Legibility. This is the most important factor in any letter design. Legibility is reduced by the use of distorted, obsolete, or obscure forms.

2. Variable Tone. Great changes in effect may be had in the same letter form simply by changing the weight of its elements.

3. Adaptability to Changes in Form. Good judgment is needed to produce varied, yet legible forms.

4. Possibility of Combining in Interesting Forms. Trade marks, symbolic uses, or reduced space may call for combinations.

Plate 52. Design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

WHAT FACTORS INFLUENCE LETTER DESIGN?

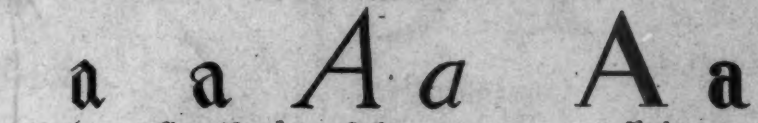
1. Historic Forms

Uncial Capitals

Roman

All our letter forms are based on the Roman letter. No radical departure long survives.

Sans-Serif



Gothic *Round Hand* *Italic* *Bodoni*

2. Manner of Production

Calligraphic Forms

Rapidly Written with Broad Pen

Initial Letter from Fust and Schoeffer Psalter
Pen-Drawn, Built-Up Letter

Each tool used leaves a definite effect on details of letter forms.

Brush-Drawn Letters

Geometric Capital - Lapidary Form

Punch and Die Making Imposes No Certain Form on Type

3. Manner of Use

The letter, whether hand-drawn or type, may be designed for an occasion or an historic period. It may display boldness and vigor, delicacy and luxury, formality and dignity, or unconventionality.

Letters may be designed for leisurely reading, for "him who runs", or to attract and hold attention. The demands of advertising have led to a continuous line of fresh styles and variants of old ones. Appropriateness for different subjects is sought in historic style, in weight, and suggestion.

Plate 53. Continuation of design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

GOOD TOOLS for School Shops

Write for Catalog No. 34 showing STANLEY TOOLS for your School Shops

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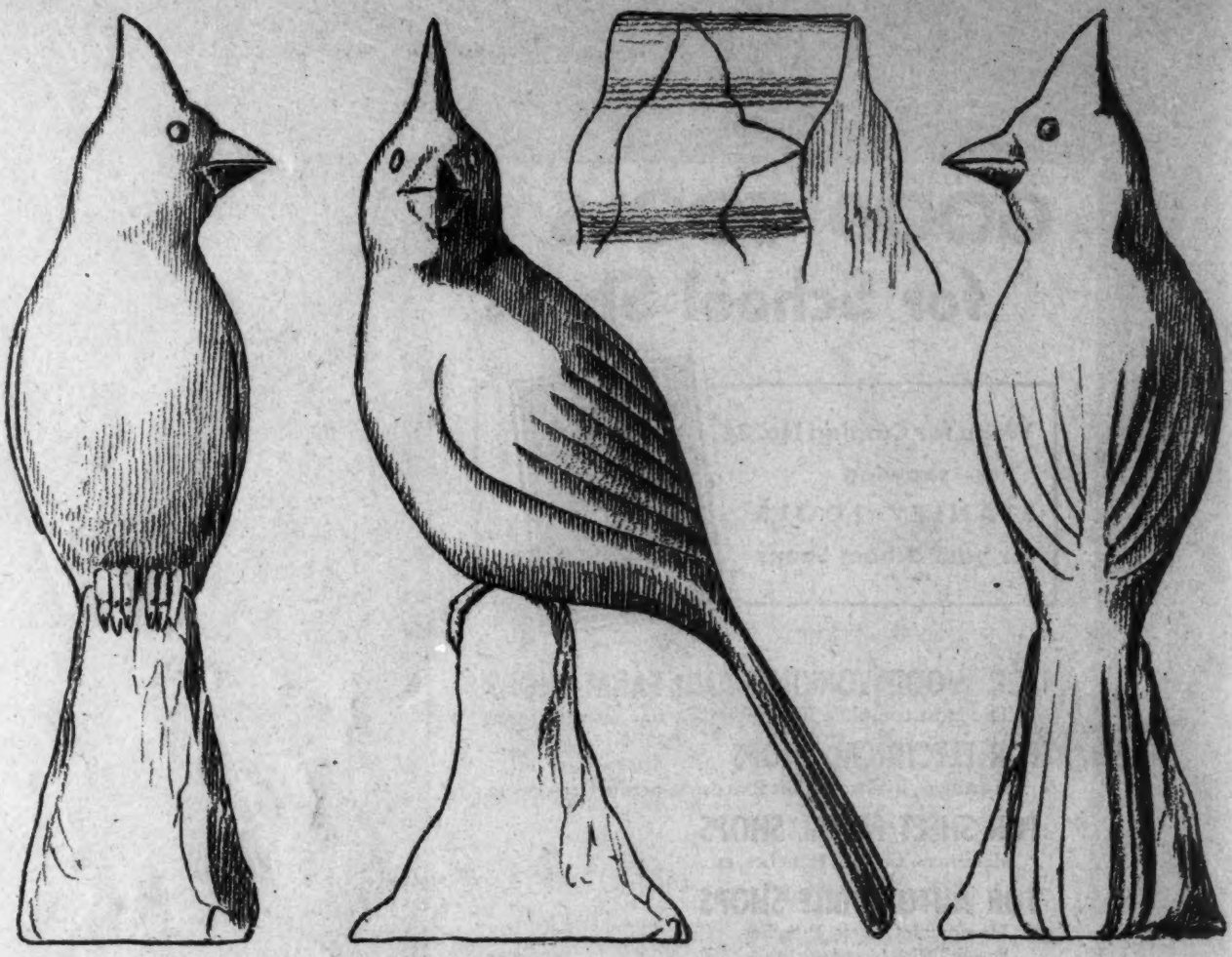

Fig. 170. Full-size pattern of the female cardinal

WHITTLING-JACKKNIFE TECHNIQUE

W. BEN. HUNT

Hales Corners, Wis.

(Continued from page 84 of the February, 1945, issue)

The Female Cardinal

One must see this bird or a good colored picture of it to fully appreciate its beauty. Quite inconspicuous in comparison with its brightly colored mate, it is nevertheless striking in its delicate shades of orange and brown. The coloring is almost impossible to describe clearly enough for one to follow when painting it. Therefore, the thing to do is to find a good colored illustration of it to work from. This can be found in almost any of the popular bird books. Accentuate the coloring when you paint your bird.

One and three quarter inch pine is required to whittle the female cardinal shown in Figure 170. Saw out the silhouette as shown in the side view. Then sketch the profile of the head on the front of the silhouette as shown in the small sketch, with the end of the beak coming right to the edge. If you wish to have your bird looking over the right shoulder, sketch it the opposite way, and to have it looking straight ahead, use the head of the front view on the body of the side view and cut out the silhouette that way.

From then on it is just plain whittling and the female is a lot simpler to carve than the male bird. After watching a pair of feeding cardinals, almost everyone will agree that the little lady is every bit as pretty as her mate and is worth while whittling.

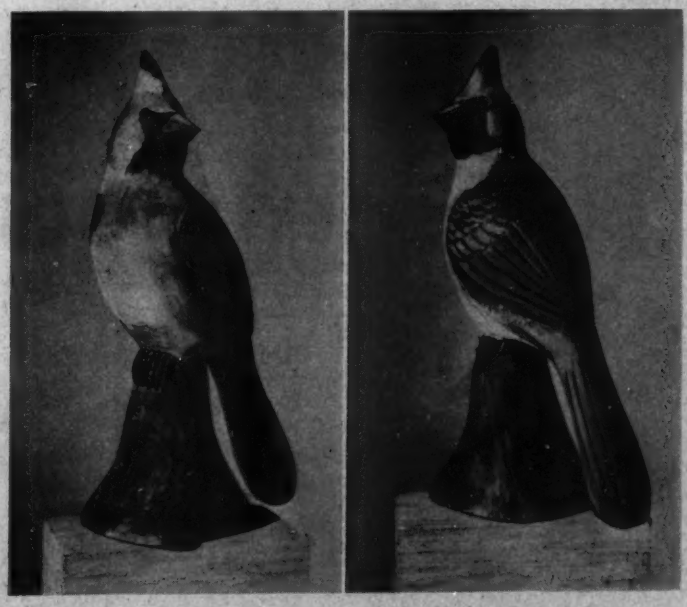

Fig. 171. Two views of the cardinal

Better Shopmen Know About Pittsburgh's

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● Color Dynamics installation in the machine shop of the Detroit radio-electronics plant of the International Detrola Corporation: "The reaction of our employees to Color Dynamics has been uniformly favorable," Detrola writes, "and we are now planning to apply these principles throughout our plant."

Color Dynamics

Scientific utilization of energy in color reduces eye fatigue, absenteeism and accidents—improves quality and quantity of production.

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They recognize that this method which utilizes the energy of color will help industry to build more and better goods—at lower costs!

The basic principles of COLOR DYNAMICS have been applied in hundreds of plants in many fields. Where *Color Dynamics* has been used more work per man-hour and more man-hours per man have resulted.

Shop executives are finding out by actual experience that eye fatigue often leads to greater physical fatigue which slows down a worker. He may become the victim of headaches, "nerves," digestive upsets, depression and many other disturbances.

Color Dynamics, based upon the simple reactions of human beings to color, lessens such eye fatigue. It reduces absenteeism, prevents accidents, betters working conditions and improves quality and quantity of production.

If you want your students to be equipped thoroughly for their future jobs, begin teaching the science of COLOR DYNAMICS as part of your regular school course.

Write today for a free copy of our book, *"Color Dynamics."* It contains a comprehensive explanation of the purposeful use of energy in color. Address Pittsburgh Plate Glass Company, Paint Division, Dept. IV-3, Pittsburgh 22, Pennsylvania.

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PUBLIC LAW 457—78th CONGRESS (H.R. 5125) ENTITLED "SURPLUS PROPERTY ACT OF 1944."

Public school officials will be interested in securing copies of Public Law 457 — 78th Congress (H.R. 5125) entitled "Surplus Property Act of 1944." This law, approved October 3, 1944, establishes provisions for the disposal of government surplus property.

Following are excerpts from P.L. 457:

"Sec. 13 (*a*) — Surplus property that is appropriated for school, classroom, or other educational use may be sold or leased to the States or their political subdivisions and instrumentalities, and to tax-supported educational institutions, and

(Continued on page 46A)

Personal News

WELL-KNOWN EDUCATOR RETIRES

Dr. William Thomas Bawden, who has been head of industrial arts and vocational education, and director of graduate courses in industrial and vocational education at Kansas State Teachers College, Pittsburg, Kans., since 1935, having reached the retiring age, will retire July 1 of the present school year.

He was born at Oberlin, Ohio, on November 6, 1875. He received the B.A. degree at Denison University, Granville, Ohio, in 1896.

In 1898 he received a special diploma for teaching shopwork and drawing from the Mechanics Institute, Rochester, N. Y. He was awarded the B.S. degree in 1903, and the Ph.D. degree in 1914 by Teachers College, Columbia University, N. Y.

Dr. Bawden's teaching experiences include mathematics, history, French, wood turning, patternmaking, and mechanical drawing.

He organized and installed the manual arts department at Illinois State Normal University, Normal, Ill., in 1903, and served as head of the department until 1910. From 1910 to 1912 he was assistant dean of the College of Engineering at the University of Illinois.

Dr. William T. Bawden

In 1914 he was appointed specialist in industrial education, and in 1919 assistant commissioner of education in the U. S. Office of Education, Washington, D. C. He left this position in 1923 to become associate superintendent of schools at Tulsa, Okla. He served in this capacity until he became managing editor of the *Industrial Education Magazine*, Peoria, Ill., in 1928. He is in his present position since 1935.

Dr. Bawden has been a most prolific writer and lecturer on subjects pertaining to industrial arts and vocational education, and has participated in more than 30 educational and industrial surveys.

Kansas State Teachers College has asked Dr. Bawden to continue on the college faculty on a part-time basis after relinquishing his present duties on July 1.

DR. HANKAMMER APPOINTED HEAD

Dr. Otto A. Hankammer was appointed as head of the department of industrial arts and vocational education effective July 1, 1945, at Kansas State Teachers College, Pittsburg, Kans.

Dr. Otto A. Hankammer

Dr. Hankammer is a native of Ohio. After being graduated from high school he attended Wooster College for one year. He received the B.S. degree from Kansas State Teachers College in 1927, and the M.A. and Ph.D. degrees from Ohio State University in 1929 and 1935 respectively.

He served as principal of the Golden Industrial Institute at Golden, N. C., for the school year 1914–15. From 1917 to 1919 he served overseas as instructor and Master Signal Electrician in the AEF Signal Corps.

(Continued on page 27A)

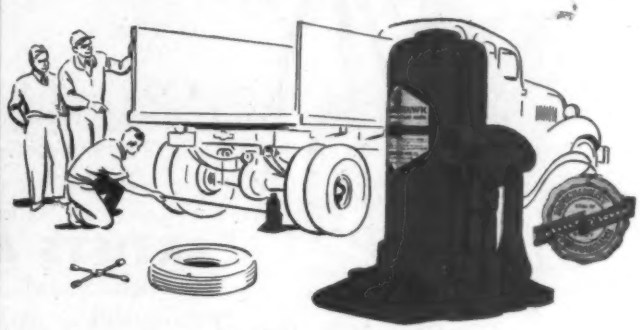
Blackhawk Shop Equipment is BASIC

...in Vocational Training and Throughout Automotive and Industrial Service

Blackhawk Wrenches teach value of multi-purpose, quality tools. Line includes Torque Indicators. A Blackhawk postwar development (Nuggets) will save school budgets up to 40% on general socket wrench investment.

Blackhawk Hydraulic Service Jacks facilitate handling vehicles in training shop. Famous 4-ton, S-4 is wise choice because of its general service and safety features.

Blackhawk Porto-Power is basic in repairing, rebuilding, and reconditioning motor vehicles. This same hydraulic equipment is used throughout industry, and is a MUST item in modern training.



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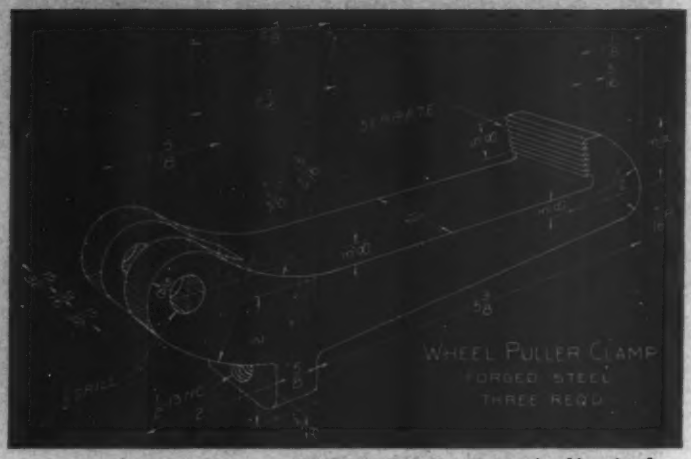

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TYPHONITE
ELDORADO

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(Continued from page 24A)

In 1922 he joined the faculty of the Kansas State Teachers College as instructor in mechanical drafting and design, and was appointed professor of industrial and vocational education in 1930.

Dr. Hankammer has been active in local, state, and national educational organizations, and also has contributed to the professional literature of his field.

ADVANCED TO THE PRESIDENCY

James McKinney, formerly vice-president and educational director of the American School, has been raised to the presidency of that national educational institution.

Mr. McKinney was field director of the education and training section of the Emergency Fleet Corporation during World War I.

James McKinney

Speaking about himself he said, "In my younger days I had the good fortune to sit at the feet of such outstanding educators as Dr. Adler, Dewey, Dean, Sneden, Bonser, Muzzey, Charters, Prosser, and Cooley. In addition to this classroom contact with these fine people, I also served a regular teachers apprenticeship under Arthur Richards and 'Skipper' Allen."

His teaching experience in this country embraces 8 years at the Ethical Culture School in New York City, 2 years at the University of Illinois as assistant professor of industrial education, and 25 years of service at the American School and American Technical Society.

Mr. McKinney is also a past president, Industrial Relations Association of Chicago; past chairman, Vocational Teachers' Round Table; past treasurer, National Vocational Guidance Association; and past treasurer, Vocational Association of Mid-West. Mr. McKinney has collaborated in the preparation of a number of technical books and magazine articles.

♦ DR. DONALD B. ARMSTRONG of New York City has been elected vice-president of the National Safety Council for home safety.

Dr. Armstrong, who is a vice-president of the Metropolitan Life Insurance Company, in charge of its welfare division, will continue as chairman of the Council's Home Safety Advisory Committee.

Dr. Armstrong long has been a leader in the safety movement. He had served as president of the American Museum of Safety; vice-president of the Greater New York Safety Council; chairman of the Committee on Prevention of Accidents, American Public Health Association; chairman, Committee on Safety Program, Technical Advisory Board, New York City Health Department. He also has been president of the National Health Council and president of the New York City Public Health Association.

He is the author of a popular book, *What to Do Till the Doctor Comes.*

Thomas Fansler is director of the Council's Home Division. His headquarters are in the National Safety Council offices, 20 North Wacker Drive, Chicago 6, Ill.

♦ ROBERT W. SCHNEIDER, head of the industrial-arts department at the high school in Highland Park, Ill., died last November.

He received his B.S. degree at The Stout Institute, Menomonie, Wis., and the M.S. degree at Northwestern University. He also studied at the University of Chicago and at Colorado State College, Fort Collins, Colo.

Prior to teaching in Highland Park, Mr. Schneider taught for six years in Wisconsin. He was engaged as a shop teacher at the high school in Highland Park in 1911. Later he was made head of the industrial arts and vocational education department, and was instrumental in organizing the vocational program at the high school.

He was a member of Phi Delta Kappa, the American Vocational Association, the Illinois Vocational Association, and the Metropolitan Industrial Arts Round Table.

He is survived by his widow and a daughter.

♦ H. A. TIEMANN, director of vocational education for the state of Colorado, has been appointed assistant superintendent in charge of vocational and adult education in the San Francisco public schools. His new duties were assumed on February 1.

♦ HERBERT C. KOLKIND has been appointed boys' counselor at the Cleveland Intermediate School, Detroit, Mich.

♦ DELMAR PARDONNET, formerly at Hutchins Intermediate School, Detroit, Mich., has been made head of the industrial-arts department at the Jefferson Intermediate School of that city.

♦ RUSSELL RICE, who was graduated from the industrial-arts department of The State Teachers College, California, Pa., in 1937, was wounded in action in Germany last September. He was hospitalized in England.

♦ C. A. DAVIS, director of diversified occupations at West Plains, Mo., last year, is now in that position in the Lexington, Mo., schools, replacing Glen Whitney, who is in the armed forces.

♦ DR. C. V. WILLIAMS passed away at Parkview Hospital in Manhattan, Kans., last Novem-

(Continued on next page)

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(Continued from previous page)

ber 16. For many years he had been head of the vocational training department at Kansas State College, Pittsburg, Kans.

Dr. Williams was with the old Federal Board for Vocational Education soon after the Smith-Hughes Act was passed. His headquarters was in Denver, and he came to Kansas and helped the vocational people draft the first state plan for vocational education. Later he came to Kansas as director.

♦ B. ALFRED COX has been transferred from Vashon High School, teaching mechanical drawing and metalwork, to Washington Technical High School, teaching Smith-Hughes machine-shop practice, related mathematics, and mechanical drawing.

♦ ANDREW D. ALTHOUSE was recently elected president of the National Association of Technical Schools and Institutes. William E. Stirton, principal of Cass Technical High School, is the secretary of this group. Arrangements have recently been made to have this organization hold its annual meetings concurrently with the convention of the American Vocational Association.

Association News

A.V.A. CONVENTION

(Continued from page 24A of the February, 1945, issue)

At the agricultural education session Friday, December 8, 1944, at 1:30 p.m., at which "Programs for Vocational Education in Agriculture" was discussed, S. M. Jackson, state supervisor of agricultural education, Baton Rouge, La., presided.

In his talk on "Conversion or Reconversion in Vocational Education in Agriculture," Arthur K. Getman, chief, bureau of agricultural education, State Education Department, Albany, N. Y., emphasized the need of area vocational schools in order that the pooling of the resources of several communities might help larger numbers of students to have an opportunity to take up specialized courses. He pointed out that in the state of New York there are 300,000 fewer students in school than children 5 to 18 years of age recorded by the census.

The subject of area vocational schools also was discussed by H. B. Gundersen, state director, trade and industrial teacher training, Salt Lake City, Utah, who stated that the complete vocational program of an area vocational school should provide:

1. Initial preparatory training to prepare youth who will not advance past the secondary school level to get and hold a job in a vocational field broad enough to give reasonable assurance of opportunity for self-support and advancement.
2. Initial preparation of youth for vocations which may require a more extended period of training than is provided by secondary schools.
3. Training and retraining for adults to assist them in "upgrading" to jobs of greater responsibility and greater remuneration.

In discussing the subject of vocational-technical education in the public school, Robert H. Spahr, member, consulting committee on vocational-technical training, U. S. Office of Education, and administrative chairman, Division of Cooperative Training Programs, General Motors Institute, Flint, Mich., stated that the present need for emergency training is due to the fact that we ignored the recommendations which came out of an international study made in the early thirties. This study showed that American industry needed three vocational-technical trained men to every four-year engineering graduate. A similar study made last year by the U. S. Office of Education shows that industry now needs five men instead of the three recommended by the earlier study.

Vocational schools must prepare:

a) To qualify people for supervisory positions in operating departments.

b) To qualify people for technical services, such as drafting, designing, testing, inspecting, setting standards, building technology, etc.

c) To qualify people with specific semiprofessional skills in such fields as art, accounting, banking, real estate, merchandising, public activities, etc.

d) To qualify people for commercial positions, relating to the sale and distribution of products and services.

e) To supply facilities for adult initial training, or retraining, or upgrading in their present work.

S. A. Greenberg, technical secretary, American Welding Society Committee on Minimum Requirements, New York City, chose for his subject "Minimum Requirements for Instruction of Welding Operators in Trade Schools." He said that the American Welding Society has already prepared two parts of a series entitled "Code of Minimum Requirements for Instruction of Welding Operators."

The war emergency has made it necessary that many be given abbreviated war-production courses. The upgrading of men who have acquired limited skill will, therefore, be an important future task for the vocational school.

"Guidance and Adjustment of Students in Vocational Schools and Classes" was discussed by William E. White, principal, H. Fletcher Brown Vocational School, Wilmington, Del. He pointed out that the functioning guidance program in a vocational school should give:

1. Information about training opportunities
2. The probable trend of employment
3. The advantage offered by the occupation
4. Working conditions, wages, and hours
5. There should be an occupational adjustment and placement service
6. The follow-up and evaluation of the graduates of vocational schools is an important phase of guidance that should not be neglected.

Fred M. Fowler, specialist, Individual Inventory and Counseling Techniques, U. S. Office of Education, Washington, D. C., in his address on "Selecting Students for Vocational Schools and Classes," stated the guidance program must:

1. Overcome the stigma attached to vocational

(Continued on page 30A)

Through fifty-seven years of specializing exclusively in lathe manufacturing the trade-wise have learned that the name SEBASTIAN means more value for their lathe-purchasing dollar.

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Protect files when not in use. In particular, do not let them lie in places where they will be exposed to moisture. Water causes rusting and rapid deterioration. Files should always be kept in a dry place that is free from moisture.

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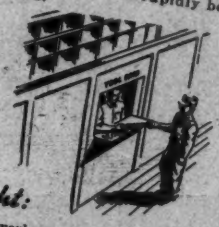

Right:
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(Continued from page 28A)

education which interferes with a free flow of students toward the vocational schools and classes.

2. Find educational opportunities suitable for students handicapped by limited abilities.

3. Surmount the barriers of misunderstandings between general and vocational education.

He outlined the following guidance procedure:

1. The Individual Inventory through which pertinent facts about students are gathered and individual characteristics are determined.

2. Informational Service by which essential data about job and training opportunities are secured and made available.

3. Counseling Service to help students make choices and plans and find solutions to problems affecting their occupational adjustment by:

a) Bringing to bear the related facts from "1" and "2."

b) Helping to interpret these facts.

4. Placement Service to give needed help to students in entering jobs, or the next step ahead in training.

5. Follow-up Service to secure facts about former students useful to the school and the guidance programs and to reveal any needs which individuals may have for further counseling, training, or special services.

Dolph Camp, supervisor, occupational information and guidance, State Department of Education, Little Rock, Ark., in speaking on the subject "Guidance and Selection of Students in the General High Schools *Before* They Enter Vocational Schools and Classes," showed the necessity of a good counseling service in the general high school which sends the student to the vocational school, as well as in the vocational school itself which must eventually place the student.

The House of Delegates meeting was held Friday evening, December 8, at 7:45. John A. McCarthy, president, American Vocational Association, presided at this meeting.

The following memorable resolutions were among those adopted by the delegates:

1. Next to winning the war and securing a lasting peace, the paramount objective of the American people is to provide peacetime jobs, with a decent standard of living for all the employable workers of this nation.

2. To attain this goal, federal, state, and local funds must be provided on a greatly expanded basis for vocational training and retraining programs for the veterans returning from military service, workers demobilized from war-production plants, and for other youths and adults so that all may attain economic stability and security.

3. Adequate financing will make possible the full utilization of the more than $10,000,000,000 work of vocational training facilities and the thousands of competent instructors, supervisors, teacher trainers, and directors of vocational education in the public vocational schools of the nation in our goal to attain economic stability and security.

4. In obtaining federal, state, and local funds for these purposes, in order that equal opportunities may be provided for all — regardless of race, creed, or color — there is no intention or desire on the part of the vocational forces on this nation to duplicate, replace, or interfere with the functions of other institutions and agencies carrying on needed educational programs.

5. The American Vocational Association recognizes the outstanding and sacrificial services rendered by the men and women serving in the armed forces of our country, and we pledge our loyal support and aid in the occupational adjustment of these loyal men and women when they return to their civil pursuits.

We believe that every returning veteran should be given the opportunity to use all of his abilities in productive work and that the Federal Government should make educational opportunities available to these veterans without financial sacrifice on their part.

Inasmuch as the veterans serve all the people we believe that the cost of such education should be borne by the Federal Government and that existing educational agencies should be used in providing the needed educational opportunities.

We also believe that in so far as possible the public and nonprofit educational institutions should be used.

Any exploitation of such a program by unscrupulous educational operators will be vigorously opposed by the American Vocational Association.

6. We recognize that during the war period American family life has been disrupted and in some cases impaired. We believe that in order to offset such a trend, a strong program of vocational homemaking education must be maintained and expanded in postwar years.

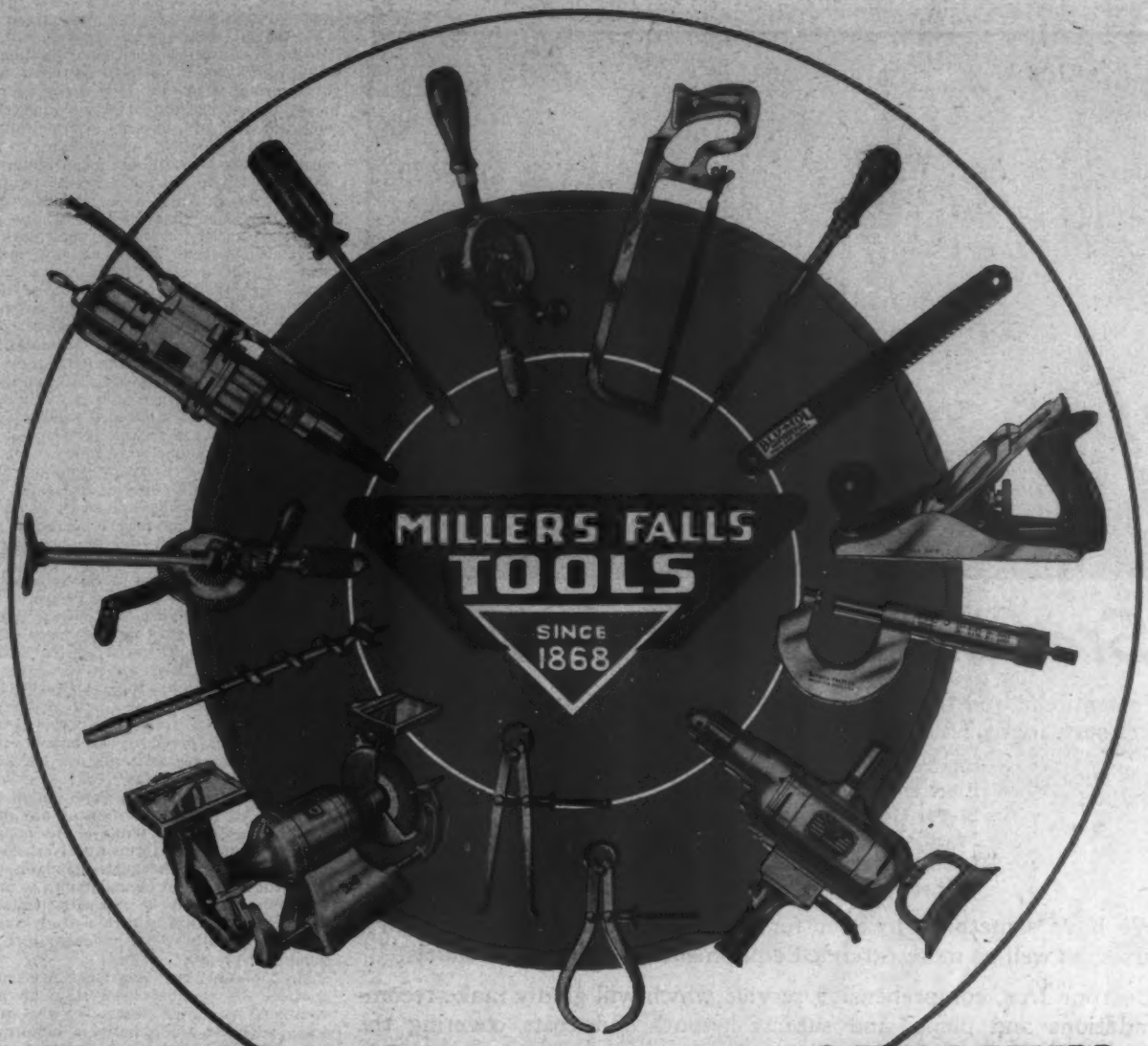
7. We are cognizant of the fact that efficient distribution of goods and services must be realized in order to maintain an effective national economy and that the distributive areas of work will provide many job opportunities in the postwar period. It is therefore suggested that school administrators give careful consideration to the possibilities of providing training for employment in the distributive occupations.

8. We recognize the extreme adjustments that have taken place in agriculture in order that the nation might produce the food required to win the war. We are also aware of the marked changes in methods of agricultural production, processing, and marketing which have occurred in recent years.

We believe, therefore, that the American Vocational Association, in cooperation with farm organizations and other interested groups, give the strongest possible support to a program of vocational education in agriculture which will meet the needs of all the rural communities of our country in the reconversion period.

9. On July 1, 1940, our President and the National Congress requested the vocational schools of the nation to help train a sufficient number of workers to make the United States the arsenal of democracy. This call to service was answered by every vocational school in the nation. Over ten million men and women have been trained in new skills, new operations, and new occupations. Many of these ten million were men and women who had never worked before. A large

(Continued on page 32A)



One thing in common—QUALITY!

Industrial arts instructors have found that quality tools give the best teaching results. So thousands of them choose and depend upon Millers Falls Tools.

There are hundreds of Millers Falls Tools with which to teach young craftsmen. From the simplest screw driver to the finest precision tool they have one thing in common—QUALITY.

Production of Millers Falls Tools is limited at present on many war-essential items. However, many others are becoming increasingly available. Soon, we hope, they may all be available to craftsmen everywhere. Ask your supplier or write to us for complete details.

MILLERS FALLS COMPANY • GREENFIELD, MASS.

"Standard" ELECTRIC SHOP EQUIPMENT

For vocational and technical schools, Standard manufactures and furnishes such items as:

Control and Distribution Switchboards
Electric Panels for the benches
Motor Generator sets of various types
Machine Terminal Panels
Loading Units
Transformer Demonstration bench units

We have something to offer for the small shop in the manual arts courses, as well as more extended equipment for the larger schools.

Use our free, comprehensive service which will gladly make recommendations and plans, and submit layouts and costs covering the materials to meet your needs and budget.

Ask us to have a nearby field engineer call and talk things over — no obligation.

Please mention *Industrial Arts and Vocational Education*

THE STANDARD ELECTRIC TIME CO., SPRINGFIELD 2, MASS.
Founded 1884

(Continued from page 30A)

per cent of them was classified as "unemployables" during the depression years. The remarkable success of this training program was largely due to (1) adequate federal appropriations with which to carry on the program and (2) the channeling of these funds by the democratic process, through the U. S. Office of Education to the states and thence to the local school authorities.

Many of these warworkers have lost the skills of their former occupations. In many instances their former occupations have so changed that they must develop a new set of skills and concepts. The welfare of our national economy demands that these men and women in industries and on the farms be retrained for pursuits and occupations that will fit them to take an honored and valued place in the ranks of workers, farmers, and homemakers in our peacetime economy.

We realize that this cannot be done unless the National Congress makes available sufficient funds to permit the vocational schools to do this much needed job.

10. We believe that in order to provide equal vocational opportunities for all, that area vocational schools must be provided. These institutions will not in any way duplicate, replace, or interfere with engineering colleges, junior colleges, land grant colleges and universities, existing local or area vocational schools, or other institutions of learning. Instead, they will supplement and strengthen our whole educational offering. They will help to serve to prevent the necessity for establishing a federalized youth training program designed to serve the 80 to 90 per cent of our population who do not go to college.

11. We are not opposing and do not intend to oppose worthy legislation or educational programs sponsored or operated by other agencies, governmental or private. It is our desire in order to prevent duplication of service and effort to cooperate with such agencies and we solicit their cooperation with us in our endeavors to provide equal vocational educational opportunities for all.

12. We believe that all federal funds made available for any type of education program or service should be channeled through the already established legally constituted educational authorities on the federal, state, and local levels. We pledge ourselves to vigorously oppose any proposal — legislative or otherwise — that does not provide for the funds to be so channeled.

13. In order to equalize educational opportunities for all it is our belief that federal aid for general education, with a minimum of federal control, should be made available to the states for general education purposes in conformity with the general principles outlined herein.

14. We shall continue to encourage the acceptance of vocational education as an integral part of the total education program. We will, however, vigorously oppose any effort to submerge or minimize through unsound administrative control and insufficient financing the importance of vocational education as a part of the total educational offering.

15. We believe that it is the responsibility of the schools to assist all the people of all the communities in solving their life problems and that the schools must provide necessary facilities and training programs so that citizens of communities may have opportunities for acquiring the necessary knowledges and skills for solving such problems.

16. In view of the popularity of vocational education at the present time, there is very grave danger that schools may offer the form and not the substance of vocational education. We therefore wish to re-emphasize our position that the success of vocational education for any individual must be measured in terms of his occupational efficiency and the performance of his duties in a democratic society. Adequate standards of vocational education must be maintained in order that such objectives may be reached. Such standards should be the result of careful study and proper consultation with school administrators and occupational groups.

17. The American Vocational Association appreciates the splendid cooperation given to the vocational education forces by the groups of organized labor, trade, business, industrial, farm, and women's organizations and associations on the national, state, and local levels. This cooperation has materially aided in providing a vitalized program of vocational education.

18. The vocational forces of the country are grateful for the emphasis being given to vocational education by school administrators on all levels.

19. Because economic stability and national security are dependent upon the highest possible degree of skill and technical knowledge of the nation's workers and because of accelerating technological advances in all vocations, the American Vocational Association insists that the public vocational schools take every possible measure to provide for the continued growth of apprentice training, and for the expansion of supplementary training for journeymen, semi-skilled workers, and all other adults who have need for vocational education.

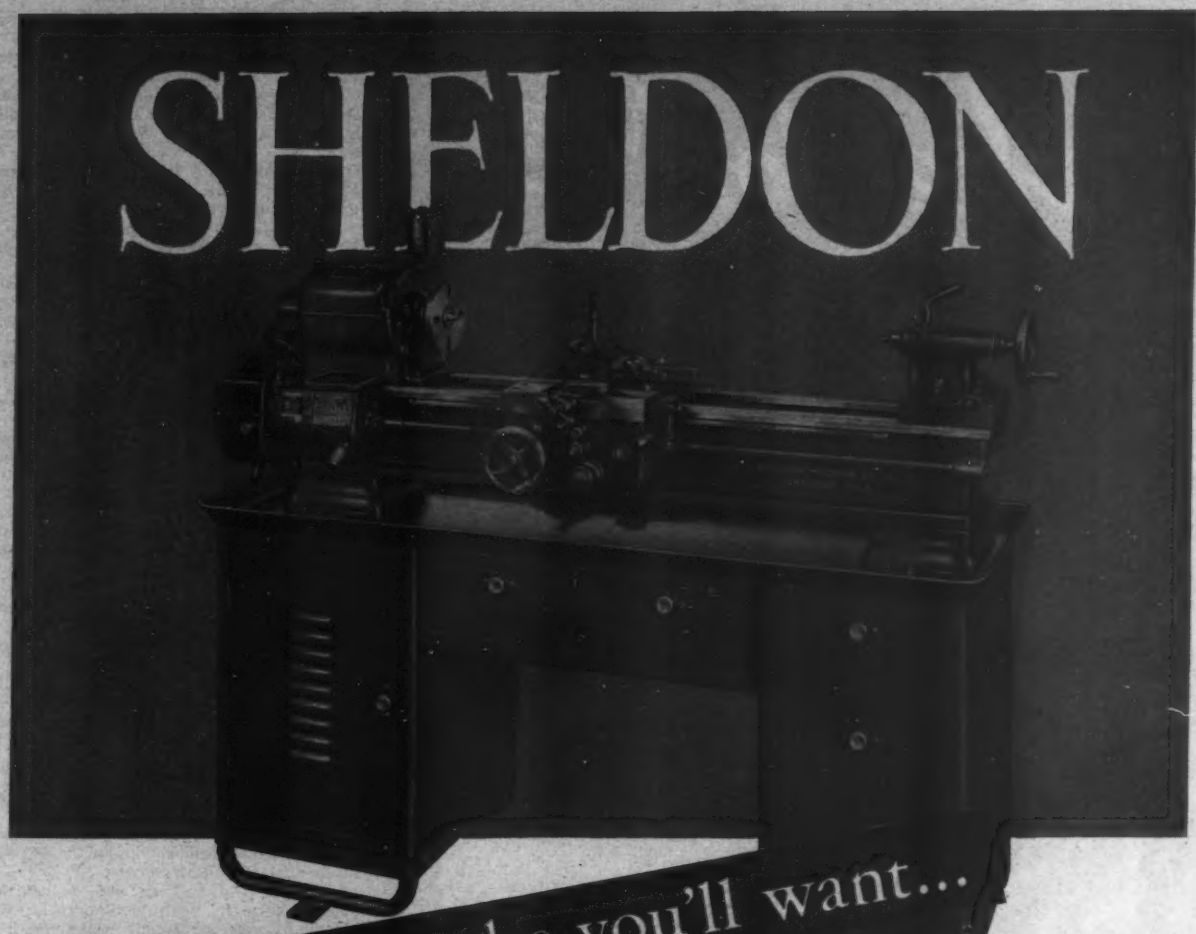
20. Because of the necessity of maintaining vocational education continuously in harmony with the requirements of employee and employer groups, the Association re-emphasizes the importance of continuing the use of functioning advisory committees representing business, industry, agriculture, homemaking, and labor for the proper guidance of each and every type of vocational education program.

21. New inventions, new manufacturing methods, and the introduction of automatic methods and controls in manufacture are constantly changing the picture of American industry. This development has permeated every phase of American life. This same tendency resulting from new appliances and methods has been reflected in agriculture, homemaking, and business.

Under the pressure of our war effort, these

(Continued on page 34A)

SHELDON

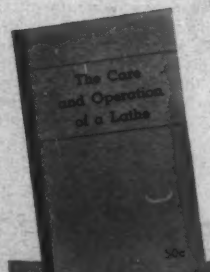


This is the Lathe you'll want...

SHELDON builds a complete line of better 10", 11" and 12" precision lathes of which the SHELDON "S-56," illustrated above, is typical. This SHELDON Precision Lathe has every advanced feature, including: *extra* collet capacity, full quick-change gear box, a fully double-walled apron with spline driven power cross feed, a more rigid "T"-strutted bed with *both* "V"-ways and "Flat"-ways which have been *both* precision ground and hand scraped to the closest limits of lateral and parallel alignment. It comes on a rigid steel bench which has 5 commodious drawers for tool holders, collets, etc. and houses the 4-speed, "V"-belt, underneath motor drive.

Built in great numbers for the Army, the Navy and the Marine Corps, this better lathe can now be offered as the finest lathe in the moderate priced field.

SHELDON MACHINE CO., Inc.
4244 N. Knox Ave., CHICAGO 41, U.S.A.



SHELDON S-56

1-inch collet capacity

SEND IN THIS COUPON TODAY

Sheldon Machine Co., Inc.
Chicago 41, U.S.A.

Gentlemen:

☐ For preferential delivery, I wish to place a tentative order for a Sheldon Lathe, this order to be confirmed by me after I have selected the model and size lathe I desire and after I have been advised as to price and delivery date.

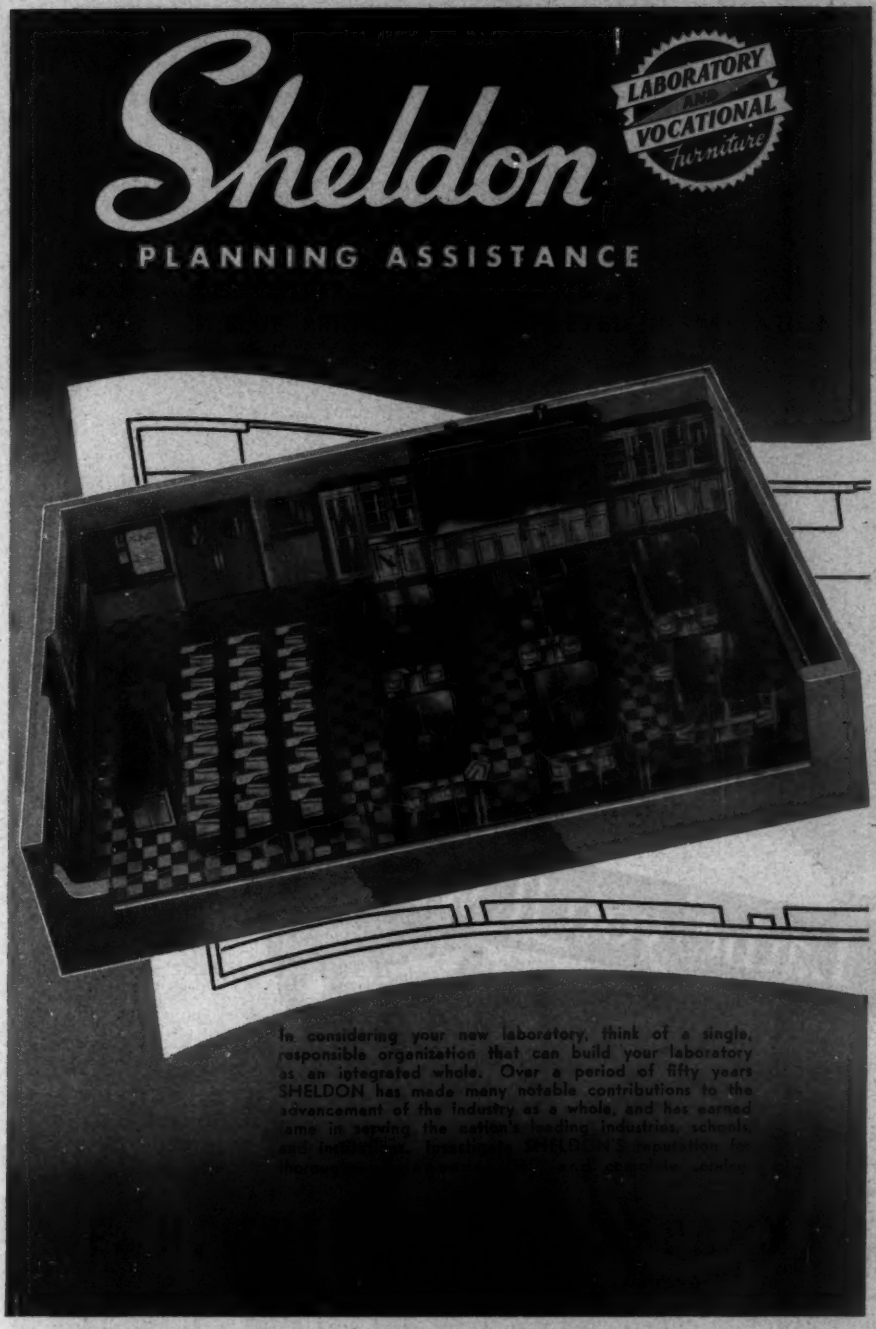
☐ Enclosed please find 50c for which please send the new edition of "Care and Operation of a Lathe" (now on the press).

☐ Send latest catalog sheets on lathes of _____ Swing _____ Bed.

Name _____

Address _____

City _____ State _____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LABORATORY AND VOCATIONAL furniture
PLANNING ASSISTANCE
In considering your new laboratory, think of a single, responsible organization that can build your laboratory as an integrated whole. Over a period of fifty years SHELDON has made many notable contributions to the advancement of the industry as a whole, and has earned same in serving the nation's leading industries, schools, and institutions. Investigate SHELDON'S reputation for

(Continued from page 32A)

new developments have not only grown tremendously but have resulted in the discovery of many new materials and new uses for old materials.

To properly handle these new materials and processes, the workers of our nation will need to be equipped with a constantly increasing fund of related technical knowledge.

We believe, therefore, that we should encourage the development of vocational-technical courses in the vocational schools of the nation to the end that in every field of endeavor we will have workers equipped to properly handle the new methods, new processes, and new materials of our postwar era.

22. In this period, when vocational education is so vitally important in the war emergency and the reconversion period which will follow cessation of hostilities, the American Vocational Association is emphatically opposed to any reorganization within the United States Office of Education which will tend to minimize the importance of vocational education. The Executive Committee of this Association is hereby urged to take whatever adequate and proper measures are necessary to prevent any reorganization that will tend to submerge or minimize the vocational education division of the United States Office of Education.

23. The American Vocational Association as an organization does not wish to take any official position either positive or negative on the question of universal compulsory military training. We are, however, emphatically opposed to the organization of any separate national program of education created under the guise of compulsory military training.

The resolutions committee consisted of Ray Fife, Ohio; Ira W. Kibby, California; Martha Creighton, Virginia; E. J. Simon, Illinois; Edward Berman, New Jersey; O. I. Paulson, Oregon; and M. D. Mobley, Georgia — Chairman.

The newly elected officers of the American Vocational Association are:

President — H. D. Mobley, State Director of Vocational Education, Atlanta, Ga.

Vice-President for Business Education — Ira W. Kibby, chief, Bureau of Business Education, State Department of Education, Sacramento, Calif.

Vice-President for Industrial Arts Education — Frank C. Moore, director of industrial arts, Cleveland, Ohio.

Vice-President for Home Economics — Anna K. Banks, state supervisor of home economics, Oklahoma City, Okla.

Past President in Charge of Vocational Guidance — John A. McCarthy, assistant commissioner of education for New Jersey, Elizabeth, N. J.

Executive Secretary — L. H. Dennis, Washington, D. C.

Treasurer — Charles W. Sylvester, director of vocational education, Baltimore, Md.

♦ The Massachusetts Industrial Education Society held an Annual Get-Together Dinner on the evening of Saturday, January 27, 1945, at the Hotel Lenox, Boston.

The slogan under which this organization is planning for postwar education is "Education for Living in an Industrial Democracy"; hence, "The Future of Industrial Arts in Massachusetts" was the subject of the main address given by Dr. Julius E. Warren, commissioner of education for the Commonwealth of Massachusetts.

Guests of the society for the evening were Dr. Charles F. Herlihy, president of the Fitchburg State Teachers College; A. Russell Mack, director of secondary education, State Department of Education; Otto E. Salak, president of the New England Industrial Arts Teachers Association; Hugh Nixon, secretary of the Massachusetts Teachers Federation; and John J. Hatch, executive secretary of the American Industrial Arts Association.

Several retiring teachers were especially honored with life memberships in the Massachusetts Industrial Education Society.

The board of directors who planned this affair are Americo B. Ventura, Somerville; A. Irving Dodge, Lexington; Joseph Rains, South Boston; Rodger M. Tolman, Winchester; John Black, Medford; Emerson Staebner, Salem; Daniel J. Sullivan, Roxbury; Gustave A. Larson, Malden; Arthur E. Robinson, Arlington; and Percy F. Marsaw, Worcester. — *Gustave A. Larson.*

♦ The Mechanical Drawing Association of New England held a dinner meeting at the Boston Architectural Center, Boston, Mass., at 6:30 p.m. on February 10, 1945.

Professor Rising of Purdue University, speaker of the evening, enlivened his presentation with some exceptionally good engineering-drawing movie films that had been taken in the drawing classes at Purdue University, Lafayette, Ind.

♦ D. F. Martinez, State Supervisor of Negro Schools, and Mrs. Alberta E. Douglas, Assistant State Supervisor, attended the plan meeting for teachers of Scott and Mississippi Counties held at Charleston, Mo., on Friday, October 27. Mr. Martinez discussed "Teacher Techniques in Rural Schools," and Mrs. Douglas spoke on "State Department Objectives for the School Year." Other participants included County Superintendent O. F. Anderson, Scott County; Mrs. Chambers of Mississippi County; Mr. Charles Bowden, principal of Lincoln High School; and Mrs. Myrtle Petigrew-Cole. Area Jeanes, supervisor of Mississippi and Scout Counties, served as chairman of the meeting.

♦ The St. Paul Manual Arts Club, St. Paul, Minn., which has been in existence for more than 33 years, presented life membership certificates to the following retired teachers:

Mellie E. Ray, former English teacher; Joseph Berger, who had charge of the millroom and supervised study periods; E. S. Donaldson, former instructor in sheet metal; J. P. Madison, instructor in cabinet making; A. D. Bailey, teacher of related subjects; and J. E. Anderson, instructor in the machine shop. Four of these — Miss Ray, Mr. Donaldson, Mr. Bailey, and Mr. Anderson — began their work in the vocational school when it was first organized in 1919.

♦ Frank R. Kepler, Supervisor of Vocational Education in the Detroit Public Schools, was

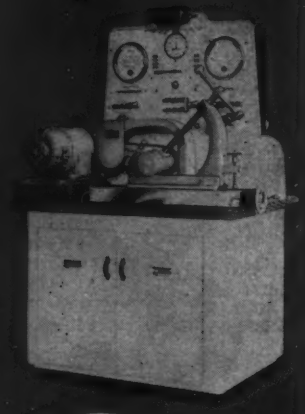
(Continued on page 42A)

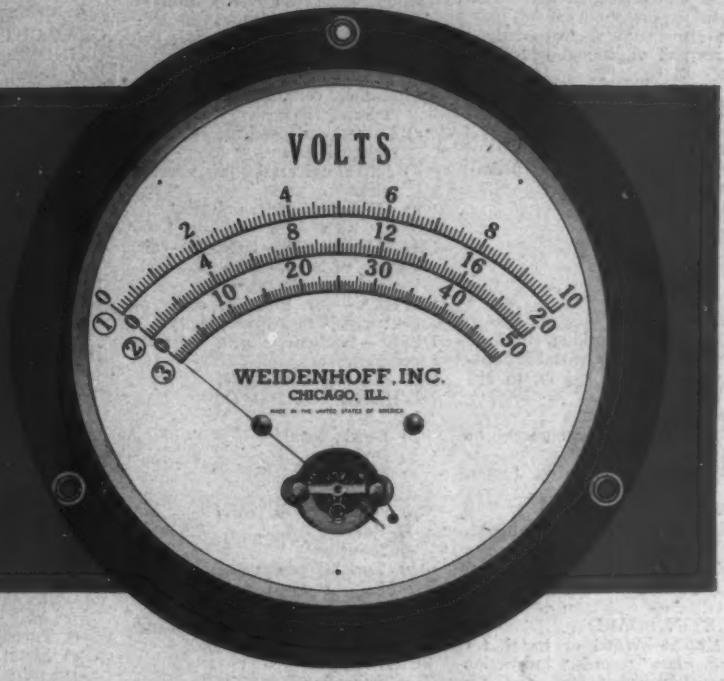
Sustained *Meter Accuracy!*

FEATURES WEIDENHOFF TEST BENCHES

A COMPLETE LINE

Whatever you need for generator and starting motor service, there is a Weidenhoff Test Bench for it. Two of the popular models are shown below; others are available. A card sent to us will bring you all the facts about Weidenhoff Test Benches.





WHEN YOU TEST GENERATORS & VOLTAGE REGULATORS YOUR METER READINGS MUST BE RIGHT

The meters of Weidenhoff Generator Test Benches hold their accuracy over exceedingly long periods of service. They are of the highest quality—precisely engineered and ruggedly built.

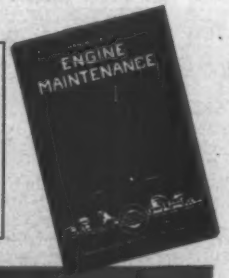
The voltmeter, for example, is the D'Arsonval heavy-duty jewel-bearing type with a knife edge pointer. Easy to read. Large diameter, clear scale calibrated 0-10 volts in 1/10 volt graduations, 0-20 volts in 1/5 graduations and 0-50 volts in 1/2 volt graduations.

Voltmeter is accurate to within 2 percent of full scale. You'll always be sure of your readings on a Weidenhoff meter.

The ammeter is a fit companion piece to the voltmeter—just as accurate, just as precisely engineered.

WEIDENHOFF PUBLICATIONS:

Handbook of Engine Maintenance — Battery Charging — Fast Battery Charging — Magnetos — Magnet and Rotor Recharging — Engine Tune-up — Generators and Starting Motors — Armature Testing — Ignition Distributors, and others. Full information available.



AUTOMOTIVE SERVICE WEIDENHOFF EQUIPMENT AVIATION

WHEN YOU BUY WEIDENHOFF YOU BUY THE BEST

JOSEPH WEIDENHOFF, INC. • CHICAGO 24, ILL., U. S. A.

Metalworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSORS — for machine shop, foundry, or forge shop
ANVIL — 100 lb.
ARBOR PRESS — bench or pedestal type
BARROWS
- a) Coke
- b) Foundry
- c) Scrap

BELT LACER
BENCHES
- a) Coremaking
- b) For metal working, iron or steel legs. Tops, metal or hardwood lumber, 1¾ in. to 2½ in. thick
- c) Molding

BLACKBOARD — permanent or portable
BLOWERS — for furnaces, forges, etc.
BLOWTORCH — 1-qt. size
BOOKCASE — for reference books, catalogs, etc.
BORING BAR
BORING MILL — vertical or horizontal
BULLETIN BOARD
CABINETS — Wood or metal, for filing class records, instruction sheets, drawings, etc., and for tools and supplies
CASEHARDENING BOXES
CENTERING MACHINE
CHAIN HOISTS — differential, duplex or triplex
CHAIRS — teacher's, and tablet arm if needed for related-subjects room, or for demonstration section
CHUCK
- a) Drill, selected sizes
- b) Lathe, combination, 4 jaw, selected sizes
- c) Lathe, independent, 4 jaw, selected sizes
- d) Lathe, universal 3 jaw, selected sizes
- e) Milling machine, universal

CORE OVEN — for foundry
CRANES AND HOISTS — air, electric, or hand, of the jib, traveling, or portable type
CUPOLA — for foundry, coke, or electric, ¾- to 1-ton capacity
DESK — teacher's, with drawer compartments
DIE-FILING MACHINE
DIVIDING HEAD
DRILLS
- a) Bench, hand
- b) Breast
- c) Electric, portable
- d) Hand
- e) Post, hand or power
- f) Radial
- g) Sensitive
- h) Upright, power

FLASKS — 2 or 3 part, steel or snap type
FORGE — coal or gas, with hand- or electric-driven blower
FURNACES
- a) Annealing
- b) Bench
- c) Brass and soft metal
- d) Combination bench
- e) Casehardening
- f) Cyanide
- g) Gasoline
- h) Heat-treating
- j) Melting

GEAR-CUTTING MACHINE
GRINDER
- a) Bench, hand or power driven
- b) Combination grinder, buffer, and polisher
- c) Emery, bench or pedestal type
- d) Face, with magnetic chuck
- e) Portable tool post
- f) Precision, for external and internal grinding
- g) Universal tool cutter, drill and reamer grinder
- h) Wet tool

HACK SAW — motor or belt driven
HAND PICKS — for cleaning inside of cupola, 1¼ to 2½ lb.
HARDNESS TESTING MACHINE
LATHES — belt or individual drives
- a) Automatic
- b) Bench, 6-in. to 11-in. swing, 11 in. to 36 in. between centers
- c) Change gear, 9-in. to 14-in. swing, 18 in. to 36 in. between centers
- d) Quick-change gear, 9-in. to 16-in. swing, 18 in. to 36 in. between centers
- e) Semiquick-change gear, 9-in. to 18-in. swing, 18 in. to 42 in. between centers
- f) Turret
- g) Metal spinning

MILLING MACHINE
- a) Plain, cone or motor-driven type
- b) Universal, cone or motor-driven type

NIBBLING MACHINE
PIPE CUTTER
PLANER — belt or motor driven
POWER HAMMER — for forging operations
PUNCHES — metal, hand, or power
PYROMETER
PYROSCOPE
RELIEVING ATTACHMENT FOR LATHE
SAND SIFTER — for foundry, hand or power
SANDBLAST OUTFIT — with cabinet
SCALE
- a) Counter for machine shop
- b) Platform, for foundry, 1000-lb. capacity

SHAPER
SNAP-FLASK JACKETS — to fit snap flasks used
STRAIGHTENING PRESS
SURFACE PLATES
SWAGE BLOCK AND STAND — for forge shop
TAPER ATTACHMENT FOR LATHE
TRUCK — warehouse
TUMBLING BARREL — for foundry
VISES
- a) Blacksmith
- b) Drill press
- c) Machinist
- d) Pipe
- e) Planer
- f) Shaper

WELDING OUTFIT
- a) Acetylene
- b) Electric

Metalworking—Small Tools

ARBORS
- a) Drill chuck to suit requirements
- b) Reamers, various sizes
- c) Shell tool, various sizes
- d) Straight shank for shell reamers and shell drills, selected sizes
- e) Taper shank for shell reamers and shell drills, selected sizes

BEARING SCRAPER
BELLOWS — for foundry class
BEVEL PROTRACTOR
BROOMS AND FLOOR BRUSHES — for shop and foundry
BRUSHES
- a) Bench
- b) Core box
- c) Core painting
- d) Hard brushes for foundry
- e) Floor
- f) Soft brushes for foundry

BULB SPONGES — for molders
DRAW PINS — for molders
CALIPERS
- a) Hermaphrodite, 4 in. and 6 in.
- b) Inside, 4 in. and 6 in.
- c) Outside, 4 in. and 6 in.

CANS
- a) Oil, 1/3 pt., 1 pt., and 10 gal.
- b) Waste

CENTER TESTERS
CHISELS
- a) Cape, 3/16 in. and 5/16 in.
- b) Cold, 5/16 in. and 3/4 in.
- c) Diamond point, 3/16 in. and 1/2 in.
- d) Roundnose, 3/16 in. and 1/2 in.

CLAMPS
- a) 4 in., 6 in., 8 in., and 10 in.
- b) Flask, for foundry
- c) Strap, various sizes

CAKE FORKS — for foundry
COLLETS
- a) For milling machine, selected sizes
- b) For lathe, selected sizes

COMBINATION SQUARES—with hardened head and blade, and protractor head, 9 in. and 12 in.
COUNTERBORES — straight and tapered shanks, selected sizes
COUNTERSINKS — for metal
CRUCIBLE TONGS — to fit crucibles
CRUCIBLES — selected sizes
- a) Shanks, single end to fit ladles
- b) Shanks, hand, to fit ladle bowls

CUTTERS — angular milling, bevel gear, concave milling, convex milling, end milling, face milling, formed milling, grooving, involute gear teeth, key seat, side milling, and metal slitting

DIVIDERS — Spring, 4 in. and 6 in.
DRILLS
- a) Drifts, different sizes
- b) Sleeves, different sizes
- c) Stand for Nos. 1 to 60
- d) Stand for 1/16 in. to 1/2 in. by 64ths

DRILLS
- a) Center
- b) High speed, taper shank, various sizes
- c) Jobbers, straight shank, 1/16 in. to 1/2 in. by 64ths
- d) Ratchet
- e) Straight shank, Nos. 1 to 60
- f) Taper shank, 1/2 in. to 1 in. by 16ths

FILE CARDS
FILES
- a) Die sinkers, various shapes
- b) Flat bastard, 8 in., 10 in., 12 in., and 14 in.
- c) Half round, double cut, 6 in., 8 in., 10 in., and 12 in.
- d) Hand, smooth, 8 in., 10 in., and 12 in.
- e) Mill, smooth, 8 in., 10 in., and 12 in.
- f) Round bastard, 8 in., and 10 in.
- g) Square bastard, 8 in., and 10 in.
- h) Swiss, various shapes
- j) Three-square, double cut, 6 in.
- k) Warding, double cut, 6 in.

FIRST-AID CABINET AND SUPPLIES
FORGE TOOLS — drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop
GATE STICKS — maple, for foundry
GAUGES
- a) Center
- b) Depth
- c) Drill and wire
- d) Screw pitch, select kinds
- e) Surface
- f) Thickness

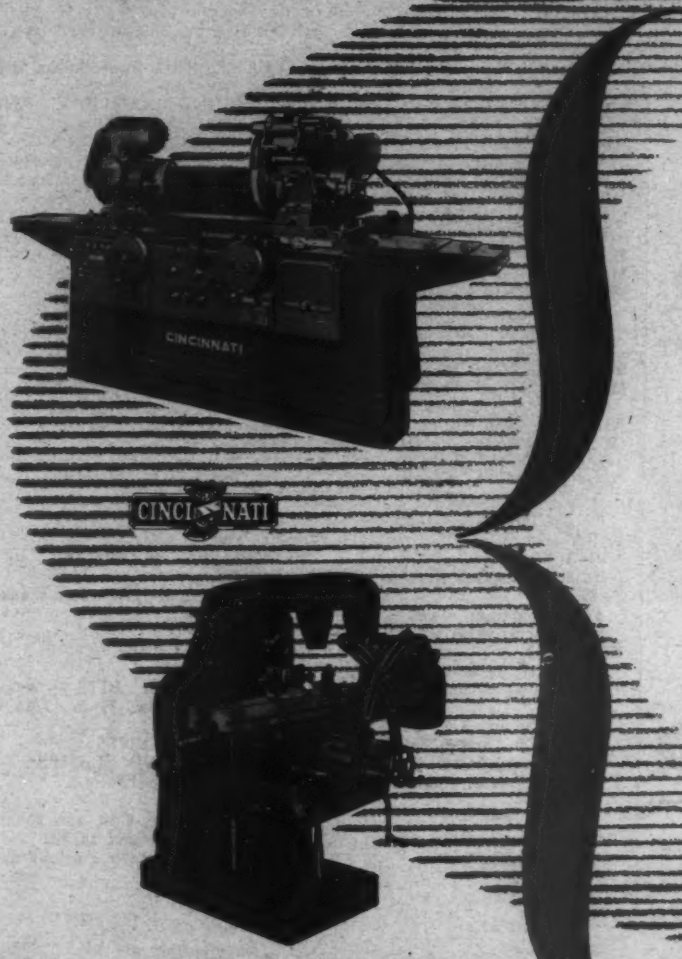
GLOVES — asbestos, for foundry
GOGGLES
- a) For machine shop
- b) For foundry

HACK SAW
- a) Blades, hand, 18T, 10 in.

(Continued on page 38A)

IF THEY WERE YOUR BOYS

you would want the best



Cincinnati No. 2 MH Universal Milling Machine. For complete information, ask for specification catalog M-1000.

Cincinnati 12" x 36" Hydraulic Universal Grinding Machine. For information, ask for specification catalog G-486-1.

Cincinnati Milling and Grinding Machines are in such universal use it's only logical they should be essential machines for your training program. So great is their acceptance in industry, students trained on CINCINNATIS just naturally fit into the scheme of things with little or no further instruction. ¶ These machines are unusually safe and easy to operate. They are versatile, accurate, and sturdily constructed to withstand the rigors of student training. Their adaptability and usefulness for training programs have been proved in scores of instances. Many standard attachments are available for these machines . . . thereby increasing the variety of work which can be assigned to the students. ¶ We suggest you investigate the two machines illustrated. On request, specification catalogs will be sent to teachers or school officials. When writing, please indicate your position.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

MARQUETTE

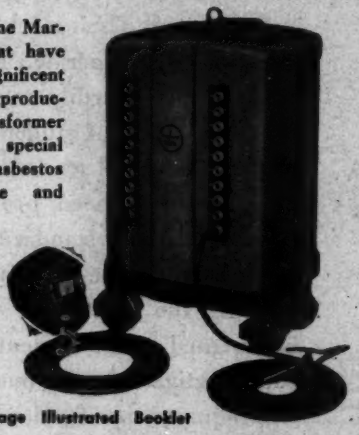
TEACHER'S PET
... WELDING EQUIPMENT

Marquette A.C. Arc Welders are *quiet*. No noisy parts, just the steady purr of the power packed transformer. Demonstrations are simplified because it is unnecessary to raise the voice to enable *all* the students to hear the instructor.

Simple as A B C . . . no confusing dials or gadgets. Each heat stage is clearly marked. The automatic voltage control assures a steady flow of matchless welding power. No "magnetic blow" to harass and confuse the student. Simplifies work sheet instructions. Students learn welding easier and quicker with Marquette A.C. Arc Welders.

TOUGH and RUGGED . . . BUILT FOR INDUSTRY

These are the same Marquette Welders that have done such a magnificent job on the nation's production lines. The transformer of silicon steel core . . . special flat copper wire . . . all asbestos insulation is trouble-free and efficient.



10 MODELS WITH THESE OUTSTANDING ADVANTAGES

- Completely equipped
- Simplicity of operation
- Automatic Voltage Control
- High power factor

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MARQUETTE
WELD-ALL ELECTRODE KIT

The same kit used in Industrial Maintenance. Ideal for student use as it contains a generous supply of twelve different types of rod in various sizes. Teach them how to choose the right rod for the job. Contains rods for Steel, Cast Iron, Malleable Castings, Hard Surfacing, Aluminum, Stainless Steel, Copper and Copper Alloys, in fact, every type of welding job. Handy chart inside kit cover describes each rod and lists the jobs for which that particular rod is designed. Comprehensive instruction booklet is included with each kit.

MARQUETTE
REGISTERED U.S. PAT. OFFICE

MARQUETTE MFG. CO., Inc.
Minneapolis 14, Minn.

WELDING *Equipment*
ELECTRODES AND SUPPLIES

(Continued from page 36A)

b) Blades, power, 14T, 12 in.
c) Frames, adjustable

HAMMERS
a) Babbitt
b) Ball peen, 13 oz., 16 oz., or 20 oz.
c) Blacksmith's, various kinds
d) Riveting, 9 oz., and 12 oz.
e) Setting

INDICATOR
a) Center
b) Universal or universal dial test
c) Speed

KNURLING TOOL — with assorted knurls

LADLES
a) Bull
b) Hand bowls
c) Melting

LATHE DOGS — ½ in., ¾ in., 1 in., 1½ in., 2 in., 2½ in., and 3 in.

LEGGINGS — fireproofed duck, to protect students when pouring in foundry

LEVEL — 6-in. bench

LIFTING SCREWS — for molders

MALLETS — wood or soft

MANDRELS — selected sizes

MICROMETERS — inside, 1½ in. to 8 in.; outside, 0 to 1 in.; outside, 1 in. to 2 in.; outside, 2 in. to 3 in.

MOLDING BOARDS

MOLDING STICKS AND TROWELS — various kinds

NIPPERS — end cutting, 5 in.

OIL STORAGE TANK — with pump

OILSTONES — medium and fine

PAILS — galvanized, 12-qt. capacity for foundry

PARALLELS
a) Adjustable
b) Steel, assorted sizes

PLIERS
a) Combination, 6 in.
b) Side-cutting, 6 in.

PUNCHES
a) Center, ¼ in. and ⅜ in.
b) Hollow, ½ in., ¾ in., and 1 in.
c) Pin, ⅛ in., 5/32 in., 3/16 in., 7/32 in., and ¼ in.
d) Prick, ¼ in.

RAMMERS — for foundry
a) Hand
b) Floor

REAMERS — various sizes
a) Adjustable
b) Hand
c) Taper pin
d) With taper shank

RIDDLES — ¼-in. and ⅛-in. mesh, 18-in. diameter, for foundry

RIVET SETS — assorted sizes

SCALES
a) Steel, 6-in., graduated 1/64 in. to ½ in.
b) Steel, 12 in., graduated to 32nds

SCREW DRIVERS — 6 in. and 9 in. blade

SCRIBERS

SHOVELS
a) Coke
b) Sand

SNIPS — tin, 3 in. straight and 3 in. curved

SOCKETS — for taper shanks, drill and tools, selected sizes

SOLDERING COPPERS AND HANDLES — 1-lb. size

SPRAY CAN — for molders

SPRINKLING CANS — galvanized iron, 16-qt. capacity, for foundry

SPRUE PICKS — for molders

SQUARES
a) Machinist's, 6 in.
b) Blacksmith's

STEEL FIGURES, ⅛ in.

STEEL LETTERS — ⅛ in.

SWABS — for molders

TAPELINE — steel, 25 ft.

TAPS AND DIES
a) Machine screws
b) Pipe
c) N.F. ¼ in. to ¾ in.
d) N.C. ¼ in. to ¾ in.

TONGS
a) Blacksmith's, various kinds
b) Pick up, for foundry
c) Shake out, for foundry

TOOL HOLDERS
a) Boring tools
b) Cutting-off tools
c) Planer
d) R.H. and L.H. offset shank
e) Shaper
f) Slotter
g) Straight shank
h) Threading

TOOL-HOLDER BITS — square, ¼ in., 5/16 in., ⅜ in., 7/16 in., ½ in.

TRAMMEL POINTS

V BLOCKS AND CLAMPS

WHEEL DRESSER

WRENCHES
a) Adjustable, 8 in. and 10 in.
b) Pipe, 8 in. and 12 in.
c) Tap, adjustable, various sizes

Metalworking—
Materials and Supplies

ABRASIVE CLOTH — aluminum oxide. Grits 320 to 24, obtainable in sheets or rolls from 1 to 28 in. wide

ABRASIVE WHEELS

ACETYLENE GAS — in drums for welding

ALUMINUM
a) Pigs for foundry
b) Sheets, tubing, rounds, shapes, wire, etc.

BABBITT METAL

BEARING BLUE

BELT DRESSING

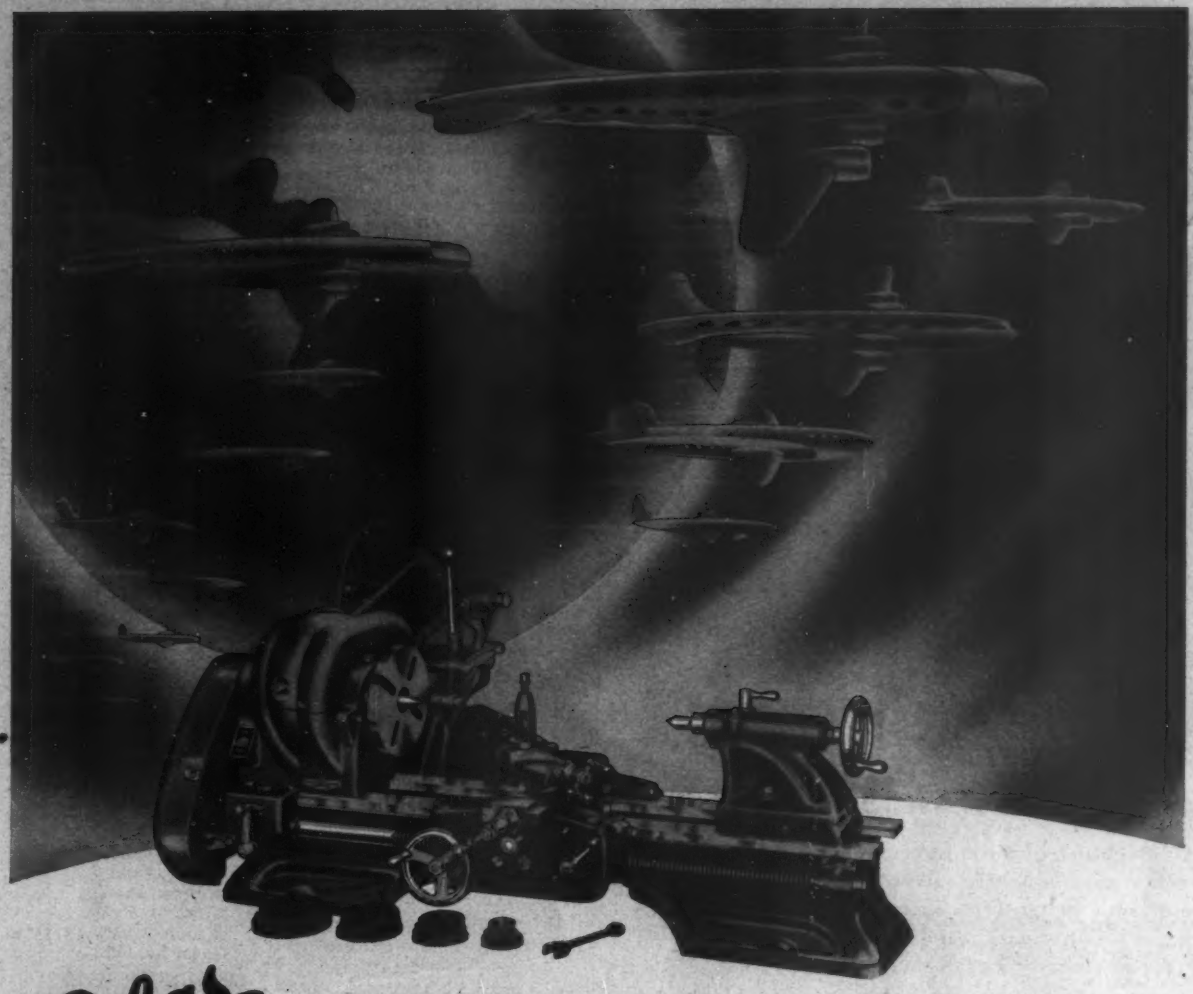
BELT LACING MATERIAL

BELT LEATHER

BOLTS
a) Carriage, selected sizes
b) Lag, selected sizes
c) Machine, selected sizes
d) N.F., selected sizes
e) Stove, flat or roundheads, selected sizes

BRASS
a) Bars, 3/32 in., ⅛ in., 4/16 in., and ¼ in. thick; ⅜ in. to 1 in. wide, 8 ft. to 10 ft. long, selected sizes
b) Round rods, 3/16 in. to ½ in. by 16ths, selected sizes
c) Sheets, 28 to 32 American gauge, 12 in. wide by 72 in. to 84 in. long, selected sizes

(Continued on page 40A)



Atlas FOR THE WORLD OF TOMORROW

The daily instruction of vocational educators has never before been so important as America looks forward to a period of amazing new developments for better living. Every industry is planning exciting new contributions.

Many of tomorrow's engineers, superintendents, foremen, and craftsmen are getting their mechanical baptism in the shops of American schools.

The war has definitely proved the importance of combining trained imagination with practical "know how" in the handling of basic tools.

Atlas tools are multiplying the opportunities for students to acquire the skills that will be so helpful in their careers.

Postwar instruction will require a great expansion in the kinds and numbers of machine tools in school shops. Get your requisitions and orders in early for next Fall's equipment. Send for latest catalogs and prices today.

ATLAS PRESS CO.

371 N. Pitcher St., Kalamazoo 13D, Mich.

Atlas 4 TOOL TEAM FOR SMALL-PARTS MACHINING

HOW TO PROPERLY USE

OPEN-END WRENCHES

Ask for FREE Data Sheet No. 22

● Although one of the most commonly used hand tools, wrenches are frequently misused by mechanics who should know better. Data Sheet No. 22 is brief, to-the-point, well-illustrated . . . and should be "required reading" for all embryonic craftsmen.

There are 24 Williams' Data Sheets covering subjects listed below. Use coupon to order those that interest you.

1. Data on "Superior" Wrenches.
2. Data on Boring Tools.
3. Data on Chain Pipe Tongs.
4. Data on "Supersocket" Wrenches.
5. Data on Lathe Dogs.
6. Data on Chain Pipe Vises.
7. Data on Turning Tools.
8. Types of "Superior" Wrenches.
9. Use of "Supersocket" Wrenches.
10. Data on Eye Bolts.
11. Data on "C" Clamps.
12. Use of Cutting-Off Tools.
13. Use of Knurling Tools.
14. External Thread Cutting.
15. Internal Thread Cutting.
16 to 21. Six Data Sheets on grinding cutters for Tool Holders.
22. Use of Open-end Wrenches.
23. Use of Lathe Dogs.
24. Use of Socket Wrenches.

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Name _____

Address _____

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WILLIAMS

SUPERIOR DROP-FORGED TOOLS

(Continued from page 38A)

d) Strips, 1/32 in. and 1/16 in. thick, ½ in. to 1½ in. wide, 50 ft. to a coil, selected sizes
e) Threaded rods, Nos. 6 to 10, in 24 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes
f) Wire, soft, 8, 11, and 14 American gauge, selected sizes
g) Wire, spring, 8 to 22 American gauge, selected sizes

CASEHARDENING COMPOUNDS

CHAPLETS — single and double head

COAL
a) Charcoal for foundry or forge
b) Coke for foundry
c) Forge

COPPER
a) Pigs, for casting alloys
b) Sheets, 8 to 25 American gauge, 30 in. by 60 in., selected sizes
c) Tubing, outside diameters, 3/16 in., ¼ in., 5/16 in., ⅜ in., ½ in.; thickness of wall, 1/32 in.; lengths, 8 ft. to 12 ft., selected sizes
d) Wire, soft, 2 to 20 American gauge, in coils. Also in ¼, ½, and 1 lb. spools, sizes 16 to 36, English gauge, selected sizes

CORE
a) Compounds
b) Flour
c) Paste
d) Oil
e) Wax-vent wire

CUTTING COMPOUNDS

FIREBRICKS AND CLAY — for foundry

FIRE HANDLES — assorted sizes

GRAPHITE — for foundry

IRON — Pig, for foundry

LACQUER — transparent and colored, for finishing

NUTS — S.A.A., acorn cap, castellated, square, hexagon, joint, and wing, selected sizes and kinds

OIL
a) Boiled linseed
b) Lubricating
c) Quenching and hardening

PACKING
Round, sheet, square, or tubular

PAINT — back asphaltum

PINS
a) Cotter, 3/32-in. to ¼-in. diam. from ½ in. to 3 in. long
b) Flask, for flask repairs
c) Taper, Nos. 0 to 6, ¾ in. to 2 in. long

PUMICE POWDER

RIVETS
a) Copper, with burrs, Nos. 7 to 14, lengths, ⅜ in. to ¾ in., selected sizes
b) Iron, No. 14 gauge to 3/16 in., flathead or button head, ¼ in. to 1 in. long, selected sizes
c) Tinners', flathead, 8 oz. to 16 lb., either tinned or black, selected sizes

SAND
a) Molding, in 350-lb. barrels or 800-lb. casks
b) Parting, in 350-lb. barrels or 800-lb. casks

SCREWS
a) Flathead or roundhead iron or brass, selected sizes and kinds
b) Cap and machine, iron or brass, selected sizes and kinds
c) Set, head and headless

SOLDER — acid or rosin core; bar, or solid wire

SOLDERING PASTE OR SALTS

STEEL
a) Bessemer, rod, 1/64 in. to ⅜ in. by 64ths, in 4-ft. lengths, selected sizes
b) Bars, cold rolled, ⅛ in. to ⅜ in. thick, ½ in. to 2 in. wide, 12-ft. lengths, selected sizes
c) Drill rod, letter sizes, A to Z, number sizes, 1 to 80, in 3-ft. lengths, selected sizes
d) Rods, hexagon and square, cold rolled, ¼ in. to ¾ in., in 12-ft. lengths, selected sizes
e) Round, cold rolled, diameters ⅛ in. to 1 in., lengths 12 ft., selected sizes
f) Sheet, black, Nos. 18, 20, 22, 24, 26, 28, U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in.
g) Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in., selected sizes
h) Threaded rods, Nos. 6 to 10, in 12-in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24-in. lengths, selected sizes

TIN
a) Pigs, for casting alloys
b) 1C, 1X, 20 by 48 in.
c) 1XX, 20 by 48 in.

WASHERS AND BURRS
a) Copper, burrs, Nos. 3 to 14, in 1-lb. boxes
b) Iron burrs, Nos. 3 to 14, in 1-lb. boxes
c) Brass washers, 3/16 in. to ⅛ in. by 16ths
d) Iron washers, 3/16 in. to ⅛ in. by 16ths

WELDING FLUXES

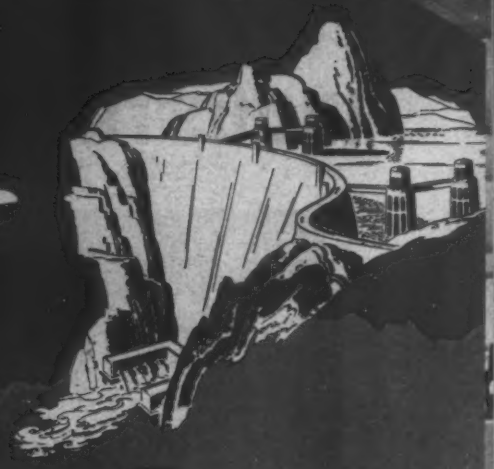
WELDING RODS (all rods come in 24-in. lengths)
a) Brazing, 1/16-in., ⅛-in., and 3/16-in. diameter
b) Cast aluminum, 3/16-in., ⅛-in., and ¼-in. diameter
c) Cast brass, 3/16-in., and ⅛-in. diameter
d) Cast bronze, ⅛-in. diameter
e) Cast copper, 3/16-in. and ⅛-in. diameter
f) Cast iron, 3/16-in., ¼-in., 5/16-in., and ⅜-in. diameter
g) Low carbon steel, ⅛-in., ⅛-in., and ¼-in. diameter

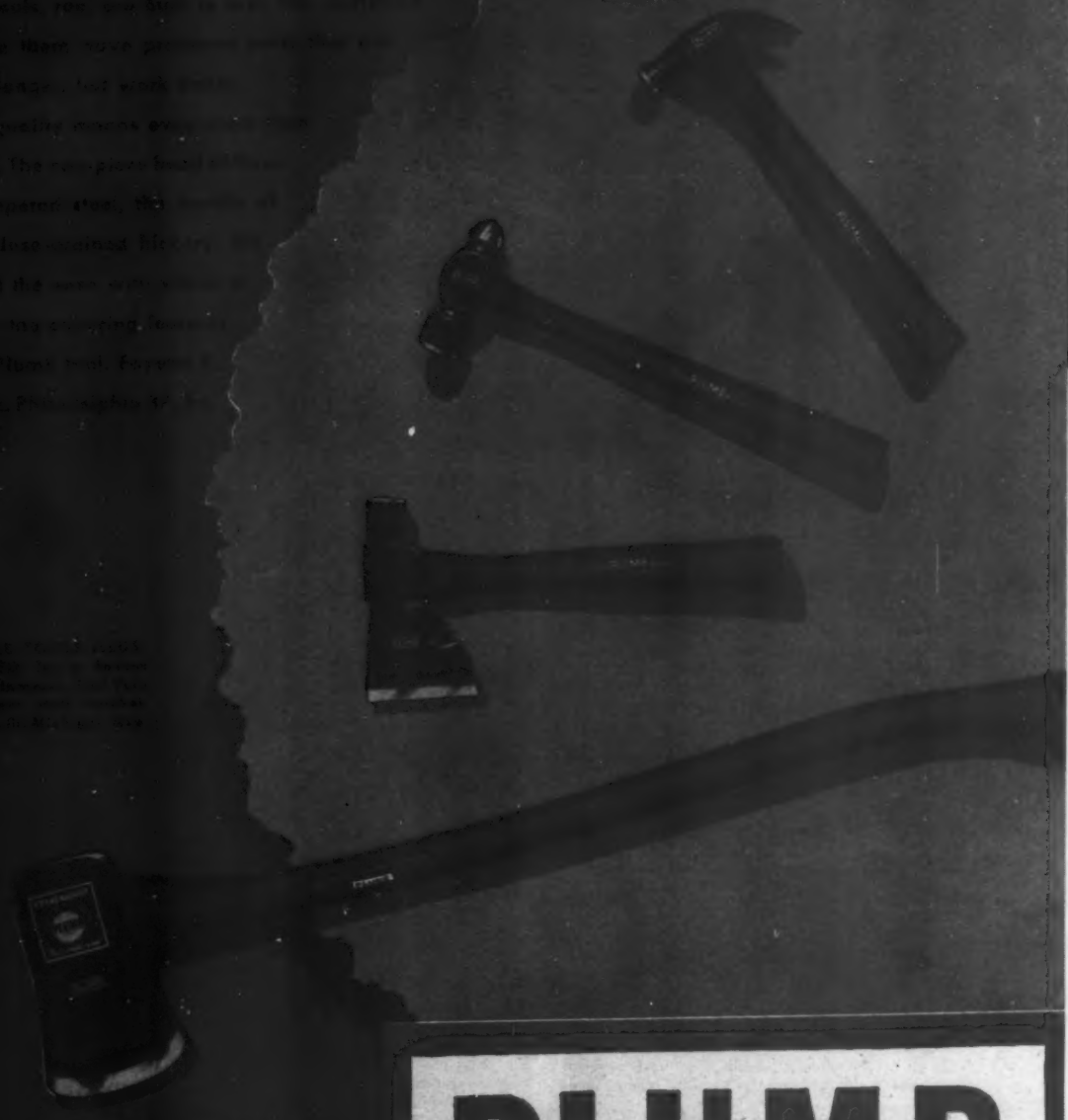
WHITE LEAD — for machine shop

WIRE
a) Annealed, 16 to 34 W and M gauge, selected sizes
b) Coppered market, 5 to 18 W and M gauge, selected sizes
c) Coppered spring, 2 to 18 W and M gauge, selected sizes
d) Galvanized, 5 to 18 W and M gauge, selected sizes
e) Piano, Nos. 2/0 to 36, selected sizes
f) Tinned, 16 to 34 W and M gauge, selected sizes
g) Wool, Nos. 0 to 3 in 1-lb. packages, selected sizes

ZINC
a) Pigs, for casting alloys
b) Sheet, Nos. 4 to 14, sheets 36 in. by 84 in.

BUILT TO LAST





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QUALITY ABRASIVES

Educational Service Department

BEHR-MANNING - - - TROY, N. Y.

(DIVISION OF NORTON COMPANY)

QUALITY ABRASIVES

(Continued from page 34A)

honored at a dinner meeting that was held at the Lee Plaza hotel in Detroit on November 3. He was presented with an honorary membership in the Mu Sigma Pi Graduate Fraternity in Industrial Education at Wayne University. Dr. Warren E. Bow, President of Wayne University and Superintendent of the Detroit Public Schools, made the presentation in recognition of Mr. Kepler's achievements in industrial arts and vocational education.

Twenty men were taken into regular membership by the Mu Sigma Pi Fraternity on this occasion.

Seated, left to right: Harris P. Moreau, Donald Zwickey, Fred E. Decker, Walter Thome, George W. Donaldson, Harry E. Keller, Ernest A. Venk, Kenneth Jackson, Lloyd B. LaVerne, Eber K. Smith. Standing, left to right: Spencer Wright, Dr. Frank Dalton, William E. Stirton, Harvey Scott, Edward Kontry, Albert E. Kreiner, Ward Smith, Milo A. Snyder, Martin A. Bornhoeft, N. Ralph Tucker — new Mu Sigma Pi members

News Notes

♦ The Studebaker Corporation has requested that the United States Office of Education furnish names of schools which offer courses in auto mechanics. Their purpose is explained in the following quotation from a letter of November 9, 1944:

"At the present time we are laying plans for a program through which our dealer establishments can utilize the placement and guidance facilities of the schools which offer work in auto mechanics training in securing auto service personnel.

"We feel that many of our dealers, especially those in the smaller communities, are not aware of the fine training many young men are receiving in the various vocational and general high schools which offer work in auto mechanics. It is our plan, therefore, to place in the hands of our dealers a list of schools in their vicinity which offer such courses, together with a plan for contacting the proper school officials so that employer and employee may be brought together. We feel that establishment of such a liaison between our dealers and these schools can be mutually beneficial."

♦ The manufacturers of Diesel engines met in Chicago with 23 deans and professors from engineering schools.

The need for improved Diesel textbooks, and the benefits that could be derived by school and manufacturer if students and even professors spent more of their time working in Diesel engine factories, was thoroughly discussed by the group.

Prof. Robert B. Rice, whose work in Diesel engine instruction at North Carolina State College is outstanding, has been engaged by the Diesel Engine Manufacturers Association as educational consultant.

♦ Descriptions and illustrations of Profilometer equipment are included in a new catalog just published by Physicists Research Co., Dept. 45, Ann Arbor, Mich.

The catalog also contains four pages of information on the nature of surface roughness, and a nontechnical description of how the Profilometer measures it for production inspection purposes.

This 20-page catalog is an enlargement of the former publication entitled "Practical Surface-Roughness Measurement."

♦ The enrollment in the machine-shop classes at the high school in Decatur, Ill., have grown to such an extent that some of them will be held each day, beginning with the new semester this month in the Millikin University shops.

C. R. Wright will be in charge of these classes, at the university, and C. W. Alberts will teach those held at the high school.

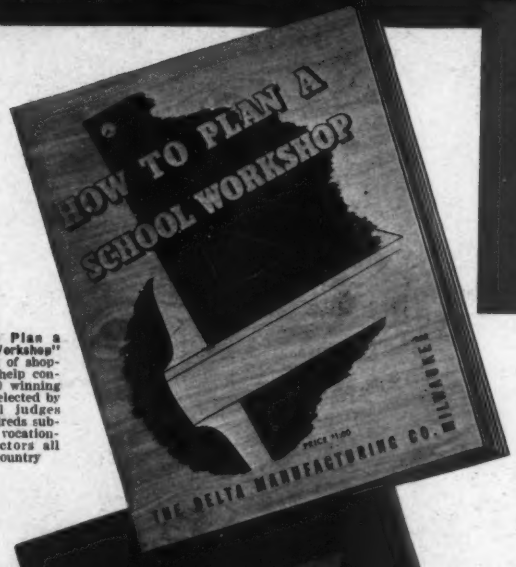
(Continued on page 45A)

help you develop a shop program that measures up to your postwar obligation

...*to* returning war veterans whose urgent need is rehabilitation.

...*to* demobilized war workers who require occupational readjustment to new peacetime jobs.

...*to* the many secondary school graduates who must be fitted to grasp the opportunities in industry for technical training of less than college grade.



"How to Plan a School Workshop" — A book of shop-planning help containing 30 winning plans — selected by impartial judges from hundreds submitted by vocational instructors all over the country

Catalog of Delta-Milwaukee Machine Tools — Illustrates and describes school shop equipment that meets the requirements of economy of purchase and operation . . . ideal size and weight . . . high standards of safety.

To a considerable degree, the decisions you make now regarding your postwar shop program determine your success — or failure — in making the most of what is potentially *the greatest vocational education project in history.*

That's why so many vocational educators — in both management and teaching capacities — have used the two Delta books illustrated here, as authoritative guides to sound, far-sighted planning and equipping.

Thorough understanding of school shop requirements — gained from long experience in the industrial arts field — permits Delta to offer you practical help.

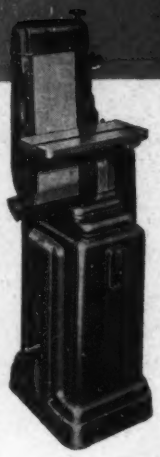
The 44-page Delta book, "How to Plan a School Workshop," provides you with photographs and layout drawings of 30 typical shops, for schools large and small. It also serves you as a condensed guide to principles of shop-planning . . . to the selection, placement, and efficient use of the major power tools.

The catalog illustrates and describes the complete line of low-cost Delta Machine Tools and shows why you enjoy advanced design, durability, safety, substantial cost savings.

Whether your present thinking is in terms of establishing a shop course or of modernizing your existing set-up, send for your free, personal copies of these two Delta books — to use as helpful working tools in formulating a program that provides greater opportunity for training to the standards of modern industry. Use the coupon on the reverse side of this page.

Delta-Milwaukee Machine Tools...

You provide greater opportunity for training to the standards of modern industry . . . with a Delta-equipped shop — and with a lower capital investment



Delta Abrasive Belt Finishing Machine

You're equipped to give students the broad scope of training that industry wants — *on the machines that industry uses* — with Delta-Milwaukee Machine Tools for woodworking and metal-working.

Here are machine tools that provide advantages favorable to your budget and working requirements:

They reduce the amount of your initial investment—and hold operating and maintenance costs to a minimum.

They are compact and portable, permitting quick floor rearrangement as projects change. Their convenient height makes operations easier for small students.

They are fully safeguarded, meeting the acknowledged rigid provisions of the Wisconsin Industrial Commission.

Make the standard in industry *your* standard — Delta-Milwaukee Machine Tools.

★ ★ ★

Certain tools are available to schools under automatic priorities (CMP Regulation 5a)

Consult your Delta Distributor.

Delta Heavy-Duty Shaper

Delta Unisaw (10" Tilting Arbor Circular Saw)

Delta Abrasive Disk Finishing Machine

Delta 14" Band Saw (wood-cutting or metal-cutting)

Delta 4-speed Scroll Saw

Delta 12" Woodworking Lathe

Delta 6" Jointer

In addition to machines illustrated, the complete line of Delta-Milwaukee Machine Tools includes:

Delta Toolmaker Surface Grinder

Delta Industrial Grinder with Safety Shields

Delta 14" Drill Press *(for metal, wood, or plastics)*

Delta 17" Drill Press *(for metal, wood, or plastics)*

Tear out coupon and mail today!

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Please send me my free, personal copy of:

☐ "How to Plan a School Workshop."
☐ Catalog of low-cost Delta-Milwaukee Machine Tools for woodworking and metalworking.

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Send for the Delta catalog of low-cost machine tools. Also get your free copy of "How to Plan a School Workshop," 44 pages of photographs and layout drawings of 30 typical school shops. Use coupon at left.

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Carter and Thompson — $3.00

If the contents of any of the above listed books are unfamiliar to you, write for EXAMINATION COPIES. They will be sent to you ON APPROVAL for a reasonable time. Persons signifying their connection with the **field of education** are entitled to the usual **discount.**

INTERNATIONAL TEXTBOOK COMPANY - Scranton 9, Pennsylvania

(Continued from page 42A)

♦ According to the United States Department of Labor, safety engineering courses have been established in the following engineering colleges: Maine, New Hampshire, Northeastern, New York, Rutgers, University of Pennsylvania, University of Pittsburgh, Pennsylvania State, Oklahoma, North Carolina State, Ohio State, Purdue, Illinois Institute of Technology, University of Alabama, Alabama Polytechnic Institute, Georgia Tech, Southern Methodist, University of Texas, Texas A. & M., University of Washington, Stanford, Oregon State, University of Colorado, Michigan State, and Minnesota.

♦ The National Pharmacy Committee on Public Information, Inc., 620 Fifth Ave., New York 20, N. Y., has released a three-colored poster to the nation's high schools, to encourage young people to enroll in colleges of pharmacy and prepare for careers in the profession.

The poster offers interested students copies of the booklet, "Your Future in Pharmacy," which describes the scholastic requirements for becoming a pharmacist and the opportunities to be found in the profession. The booklets may be obtained by writing to the address given.

♦ The DoAll Trade School, organized in 1941, and formerly located at Minneapolis, is now in a large modern plant in Des Plaines, Ill.

Trainees spend 74 per cent of the total training time in practical shop work in the new contour machining course of four weeks.

♦ The school teacher shortage may be on the decline, if the 27.8 per cent gain in enrollment figures at the School of Education, Syracuse University, is indicative of a nationwide trend.

Enrollment figures show that 607 students are registered in School of Education courses this year, as compared to 475 last year, an increase of 132.

♦ A new educational department, co-ordinating all of the company's relations with schools, colleges, and universities, has been announced by the Westinghouse Electric and Manufacturing Company.

The new department, located in Pittsburgh, Pa., will have three main divisions. The first of these, School Service, provides teaching aids and science information to all schools and educational institutions up to and through the high school level. Charles W. MacLean, present manager of the division, will continue in that position.

A second division, University Relations, maintains close contact with colleges and universities, administers the company's numerous scholarships and fellowships, and supervises the recruiting of graduate student employees. Howard C. Madsen has been named manager of this division.

The training of all graduate students for engineering, manufacturing, sales, and other departments of the company is supervised by the third division, Student Training. O. D. Montgomery has been appointed manager of this division.

♦ The American Brass Co., Ansonia, Conn., presents a new Anaconda Copper film in natural color.

This new talking picture gives instruction in the methods of manufacturing copper and brass for war and peacetime uses, with some emphasis on the former.

♦ According to Brig. Gen. Frank Hines, head of the Veterans Administration, about 20,000,000 persons will need vocational rehabilitation by the end of the war.

♦ Encyclopaedia Britannica Films, Inc., Chicago 6, Ill., is now distributing visual learning guides for use with Erpi classroom films published by Audio-Visual Council, Inc., Chicago.

This self-testing device without penalty, was developed under the direction of prominent educators. The guides help to emphasize the educational aspects of the films and assure greater student achievement.

♦ The Linde Air Products Co., 30 East 42nd St., New York 17, N. Y., has prepared 35mm. slide films covering welding, cutting, and safety, to aid instructors of welding. The films are available at all Linde offices at $3 per teaching unit. Each unit consists of one slide film, 25 lesson booklets for the students, and three instructor's manuals.

♦ Walter O. Gutlohn, Inc., 25 West 45th St., New York 19, N. Y., announces the release of a special catalog of 16mm. motion pictures to be used as a teacher's guide in the selection of visual material for instructional purposes.

This film catalog is comprised of three sections: the first contains films selected and evaluated by different curricular panels composed of education specialists in their particular fields under the supervision of the Advisory Committee on the Use of Motion Pictures in Education.

The second section lists those films approved by one or more of the following: W. H. Wilson Educational Film Libraries, Association of School Film Libraries, Dr. Hollinger of Pittsburgh School and other representative groups and individual teachers, and Teacher Committees of Indiana University.

The third section contains recently released subjects together with other carefully selected films which have not as yet been previewed by any educational film evaluation committee, but which will find a prominent place in the field of teaching.

♦ "Air Transportation Jobs and You" is the second in a series of slide films presented by United Air Lines. It is designed primarily to explain the various jobs in the field of air transportation. This slide film was prepared by the Department of School and College Service of United Air Lines and is distributed by the Society for Visual Education, Inc., 100 East Ohio St., Chicago 11, Ill.

The manual accompanying the slide film is unique in presenting frame by frame exactly the illustrations used in the slide film. This enables the instructor to prepare for presentation without actually projecting the various pictures in the slide film.

The slide film and manual are available without charge to any school or training organization which has appropriate projection equipment and may be interested in using this series of pictures.

♦ The use of kodachrome slides to promote interest among art students has been adopted by the Art School of Cooper Union, Cooper Square, New York 3, N. Y. The slides, which reproduce selected examples of student work, are available to selected groups of students in high schools, preparatory schools, and colleges with a definite interest in art.

Automotive Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that gills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSOR
- *a*) 3 to 4 cu. ft., with tank, piping, and motor
- *b*) Small portable, 1 cu. ft., with motor

ALIGNING JIG — for connecting rods

ANVIL
- *a*) No. 100 or No. 125
- *b*) Rim

ARMATURE GROWLER AND TESTER

AXLE STANDS

BATTERY EQUIPMENT
- *a*) Cell tester, panel type with discharge rack
- *b*) Charger (15-battery size) with rack
- *c*) Charger (6-battery size)
- *d*) Gas stove (small)
- *e*) Lead-burning torches, with gauges and piping
- *f*) Plate racks

BENCH
- *a*) Electric test, elaborate
- *b*) Electric test, simple
- *c*) Work, with vises
- *d*) Work, portable with vise

BLACKBOARD

BLOWTORCHES — 1-qt. size

BOOKCASE

BRAKE
- *a*) Adjusting stand
- *b*) Band-lining machine

BULLETIN BOARD

CABINETS
- *a*) Wood or metal, for bolts and supplies
- *b*) Wood or metal, for filing job sheets and correspondence

CHAIN HOIST — with overhead trolley and track

CHAIRS
- *a*) Teacher's
- *b*) For tables, or with tablet arms

CRANE — portable

CRANKSHAFT TRUING TOOL

CREEPERS

DESK — teacher's

DRILL
- *a*) Breast
- *b*) Hand
- *c*) Electric portable, ½ in.
- *d*) Electric portable, ¼ in.
- *e*) Press, 21 in., with motor and chuck

DYNAMOMETER — electric

FORGE — with blower and tools

FURNACES — gas

GREASE DISPENSERS

GRINDER
- *a*) Cylinder with motor
- *b*) 8 in., with motor
- *c*) 12 in., with motor

HONES — cylinder

JACKS
- *a*) Lever, 1½-ton
- *b*) Floor, roller

LATHE
- *a*) 11 in. by 4 ft., with motor, chucks, and attachments
- *b*) 16 in. by 6 ft., with motor, chucks, and attachments

PRESS
- *a*) Arbor
- *b*) 30 ton

SPRAY PAINTING OUTFIT

VALVE REFACING MACHINE

VULCANIZER
- *a*) Electric steam for tube work
- *b*) Small, hand

WELDING OUTFIT — with tanks, gauges, and cutting torch

WHEEL ALIGNMENT
- *a*) Gauge
- *b*) Test table

Automotive Shop—Small Tools

ABRASIVE — rubstone for cleaning castings in foundry

ALCOHOL TESTER

BATTERY
- *a*) Cell tester, prod type
- *b*) Cell tester, cadmium
- *c*) Clips, large
- *d*) Element pullers
- *e*) Fillers
- *f*) Funnels, glass
- *g*) Hydrometer, acid
- *h*) Knives
- *i*) Post builders
- *j*) Post drills
- *k*) Post markers
- *l*) Separator trimmer

BITS
- *a*) Expansive
- *b*) Ratchet brace
- *c*) Wood, 3/16 in. to 1 in.

BOLT CUTTER — 24 in. and 36 in.

CALIPERS — 6 in. inside and outside

CANS
- *a*) Oil, 1/3 pt.
- *b*) 1 gal., gas, safety
- *c*) 5 gal., gas, safety
- *d*) 5 gal., kerosine
- *e*) Waste

CHECKS — tool, 1000, blank

CHISELS
- *a*) Cape, 3/8 in. and 5/8 in.
- *b*) Cold, 3/8 in., 5/8 in., 3/4 in., 1 in.
- *c*) Diamond point

COMBINATION SQUARES — 12 in.

COTTER-PIN EXTRACTOR

DIVIDERS — 6 in. and 10 in.

DRILL SETS
- *a*) 1/32 in. to ½ in., by 64ths
- *b*) ½ in. to 1¼ in., by 32nds

FILE CARDS

FILE HANDLES — assorted

FILES
- *a*) Flat bastard, 6 in., 8 in., 10 in., and 12 in.
- *b*) Half round, 6 in., 8 in., 10 in., and 12 in.
- *c*) Mill, 6 in., 8 in., 10 in., and 12 in.
- *d*) Round, 6 in., 8 in., 10 in., and 12 in.
- *e*) Square, 8 in., 10 in., and 12 in.

FIRE EXTINGUISHERS — Pyrene and Acid

FIRST-AID CABINET AND SUPPLIES

FLOOR BRUSHES — 18 in.

FUNNELS — tin, assorted sizes

GAUGES
- *a*) Air pressure
- *b*) Center
- *c*) Depth
- *d*) Thread
- *e*) Thickness

GLASS CUTTERS

GOGGLES

GREASE GUNS — plain and pressure type

HAMMERS
- *a*) Ball peen, 4 oz.
- *b*) Ball peen, 1¼ lb.
- *c*) Ball peen, 2 lb.
- *d*) Lead
- *e*) Riveting
- *f*) Sledge, No. 12

LADLE
- *a*) 3-in. bowl
- *b*) 6-in. bowl

LAMPS — extension, with reels

LEAD POT — gas

MAGNET CHARGER

METERS — volt and ammeter test

MICROMETERS
- *a*) Outside, 0 to 1 in.
- *b*) Outside, 2 in. to 3 in.
- *c*) Outside, 3 in. to 4 in.
- *d*) Inside, 1½ in. to 6 in.

MOLDS
- *a*) Battery nut
- *b*) Battery post
- *c*) Battery strap
- *d*) Burning stick
- *e*) Lead hammer

OILSTONE

PIPE TAPS — ⅛ in., ¼ in., ⅜ in., and ½ in.

PLIERS
- *a*) Combination, 6 in.
- *b*) Flat nose
- *c*) Roundnose

PULLERS
- *a*) Bearing
- *b*) Gear
- *c*) Wheel, hub type

PUNCHES
- *a*) Center
- *b*) Taper pin
- *c*) Blacksmith

PUTTY KNIVES

(Continued on page 48A)

SURPLUS PROPERTY ACT

(Continued from page 24A)

to other non-profit educational institutions which have been held exempt from taxation. . . ."

"Sec. 13 (*b*) — ". . . whenever the government agency authorized to dispose of any property finds that it has no commercial value or that the cost of its care and handling and disposition would exceed the proceeds, the agency may donate such property to any agency or institution supported by the Federal Government or any State or local government, or to any non-profit educational or charitable organization. . . ."

The Department of Public Instruction will keep school administrators advised of the organization and procedure for the distribution of surplus property just as soon as the federal agencies announce their organization and policy.

NYA Personal Property

The Labor-Education Appropriation Act (H.R. 4899, Public Law 373, 78th Congress) approved by Congress on June 28, 1944, carried the following provision:

"Provided further, That any personal property formerly belonging to the National Youth Administration and loaned to any public school, school system, or institution of higher education within any state under the provisions of Public Law 140, Seventy-eighth Congress, under the heading, War Manpower Commission, shall vest in, be, and become the property of such school, school system, or institution of higher education in which such property is located."

GREAT INVENTOR DIES

Dr. Thomas Midgley, Jr., who discovered the antiknock properties of tetraethyl lead, died suddenly at his home in Worthington, Ohio, on November 2, 1944, at the age of 55.

Although Dr. Midgley had been an invalid for the past four years as a result of an attack of infantile paralysis, he was active up to the last as an officer of the Ethyl Corporation and Kinetic Chemicals, Inc., and as president of the American Chemical Society. Less than two months before his untimely death he presided at the meeting of the American Chemical Society in New York City.

His discovery of tetraethyl lead as an antiknock agent was made after he and his colleagues in the General Motors Research Laboratories had tried thousands of other chemical compounds without success.

The performance of the modern military and transport plane is due largely to the development of high-octane gasoline, a development in which tetraethyl lead, now a vital war material, has played an important role.

Dr. Midgley contributed largely to the knowledge of the chemistry of rubber and the methods of synthesizing rubber. With Dr. Albert L. Henne of Ohio State University, he developed organic chlorofluorides which have been widely used as noninflammable nontaxic refrigerants. He was associated with the developments connected with the recovery of bromide from sea water.

Last June, Ohio State University conferred upon him the honorary degree of doctor of science. At the time of his death he was both president and chairman of the board of the American Chemical Society, vice-president of the Ohio State University Research Foundation, vice-president of Ethyl Corporation, vice-president of Kinetic Chemicals, Inc., and a director of the Ethyl-Dow Chemical Company.

Dr. Midgley was born on May 18, 1889, at Beaver Falls, Pa. His father, Thomas Midgley, an inventor and manufacturing executive, came to the United States from London, England, at the age of six. Dr. Midgley was educated in the public schools of Ohio and at Betts Academy, Stamford, Conn. He received the

(Continued on page 58A)

WHEN VETERANS MARCH INTO THE SHOPS

Even as they approach completion of the greatest industrial training program in history, America's school shops face a new assignment, tremendous in scope, vitally important.

Are school shops ready for the task of training swelling armies of returned service men? Not quite. Not yet. *They couldn't be . . .* because these years of war shortages and rigid priorities have denied them much of even the most obviously needed equipment.

The *re-tooling program* which must now be undertaken may be viewed as a challenging opportunity. Past inadequacies of equipment *can and should* be eliminated. The nature of the job ahead leaves no place for compromise with anything short of the most modern, advanced equipment for every training purpose.

We believe this applies with particular emphasis to *mechanics' tools* of every type. Respect for fine tools—and keen appreciation for the better, faster workmanship they deliver—is fundamental in training the productive craftsman of the future. To the staffs of school shops everywhere Snap-On offers the personal services and counsel of tool experts, located in principal cities from coast to coast. The new Snap-On catalog of 3,000 hand and power tools will be sent on request. Address,

SNAP-ON-TOOLS CORPORATION

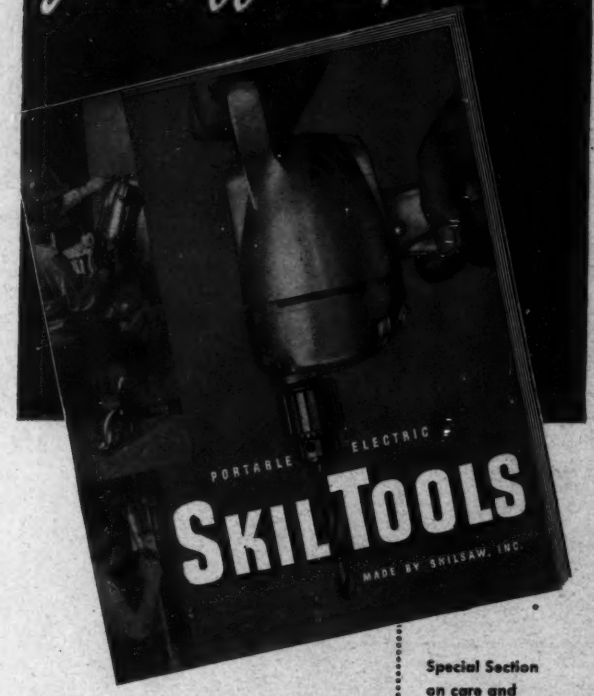
8074-C 28th AVENUE KENOSHA, WISCONSIN

Send FOR THIS NEW

SKILTOOL CATALOG

and MAINTENANCE MANUAL

just off the press!



● Every shop instructor who uses portable electric tools needs this manual to help make tools do their job better and last longer. The SKILTOOL Maintenance Manual in the SKILTOOL CATALOG is packed full of useful information on the care and economical use of *all* portable electric tools. Whether you use SKILTOOLS exclusively . . . or whether you also use other makes . . . you'll save money and delay the need for tool repair by reading and heeding the advice in the new SKILTOOL Maintenance Manual and Catalog. It's yours for the asking. Mail the coupon today!

Special Section on care and operation of Electric Tools, including:

DO'S AND DON'TS that help make tools last longer

CARE OF MOTORS, etc.

How to get the most from your portable electric tools

SKILSAW, INC., 5033-43 Elston Ave., Chicago 30, Illinois

Please send.....free copies of your new SKILTOOL Catalog with Special Tool Maintenance Section to:

Name.....

School.....

Address.....

City.....*State*.....

(Continued from page 46A)

REAMER — spindle bolt
REAMER SETS
- *a*) Piston pin, ⅛ in. to 1⅜ in.
- *b*) Taper pin
- *c*) Valve seat

SAWS
- *a*) Hack, frames, 10 in., adjustable
- *b*) Hack-saw blades, 18, 20, and 24 teeth
- *c*) Hand

SCALES
- *a*) Steel, 6 in., graduated 1/64 and 1/100 in.
- *b*) Steel, 12 in., graduated 1/32 in.

SCRAPERS
- *a*) Bearing
- *b*) Carbon

SCREW DRIVERS
- *a*) 6 in. and 12 in.
- *b*) Small combination

SCREW EXTRACTORS
SCRIBERS
SNIPS — tin, 3 in. straight and 3 in. curved
SOLDERING COPPERS — 1, 2, and 3 lb. with handles
SPRING SPREADERS
STAMPS
- *a*) Figures, 3/16 in.
- *b*) Letters, 3/16 in.

TAP-AND-DIE SETS
- *a*) Machine screw
- *b*) N.F. ¼ in. to 1 in.
- *c*) N.C. ¼ in. to 1 in.

TIRE TOOLS
TOOL KIT — metal box or canvas roll, empty
TWIST DRILLS — (extra sets) selected sizes
VALVE
- *a*) Grinders (hand)
- *b*) Spring lifters

WRENCHES
- *a*) 8 in., 10 in., 12 in., and 18 in.
- *b*) Ignition sets
- *c*) Pipe, 10 in., 14 in., 16 in., and 18 in.
- *d*) Rim socket
- *e*) Socket sets, large assortment with case
- *f*) Spark plug
- *g*) Speed wrenches
- *h*) Standard end sets, ¼ in. to ⅞ in., N.C. and N.F.
- *i*) Valve-tappet wrenches

Automotive Shop— Materials and Supplies

ACETYLENE GAS — in drums, for welding
ACID
ALCOHOL
BABBITT
BEARING BLUE
BEARING COMPOUND
BOLTS
- *a*) Machine, selected sizes
- *b*) N.F., selected sizes
- *c*) Stove, flat or round heads, selected sizes

BRAKE JUICE — ½-pt. cans
BRUSHES
- *a*) Paint
- *b*) Spark plug
- *c*) Spoke
- *d*) Steel
- *e*) Varnish

CHAMOIS
COIL-SPRING ASSORTMENT
COPPER TUBING
COTTER PINS — assorted sizes
CROCUS CLOTH
DISTILLED WATER
DRAIN COCKS
ELECTROLYTE
EMERY CLOTH — Nos. 2/0, 0, ½, and 1
ENAMEL — AUTO PAINTING
GASKETS
- *a*) Copper asbestos
- *b*) Cork and felt
- *c*) Flange

GASOLINE
GREASE — cup, cans
KEROSINE
KEYS, WHITNEY — assorted
LACQUER — colors
LEAD
LUBRICANT — transmission
NAILS AND BRADS
NUTS
- *a*) N.F., castellated, square, hexagon, selected sizes and kinds
- *b*) N.C., square and hexagon, selected sizes
- *c*) Machine screw, selected sizes
- *d*) Wing, selected sizes

OIL
- *a*) Cylinder, light, medium, and heavy
- *b*) 600W
- *c*) Penetrating

OXYGEN — in drums for lead burning
PIG LEAD
PISTON-RING COMPRESSORS
RADIATOR HOSE
RIVETS — brake lining, 5/16 in., ½ in., and ¾ in. long.
SANDPAPER — Nos. 2/0, 0, ½, and 1
SCREWS
- *a*) Flathead or roundhead, iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron, or brass, selected sizes and kinds

SEALING COMPOUND
SHELLAC — ½-pt. cans
SHIM STOCK
SOAPSTONE
SOLDER — bar, wire, or self-fluxing wire
SOLDERING PASTE
SPELTER — for brazing
SPONGES — ½ lb.
STARTING CABLE
TACKS AND STAPLES — upholstery
TIRE
- *a*) Carcass fabric
- *b*) Cushion stock
- *c*) Inner-tube repair stock
- *d*) Patching cement
- *e*) Patches
- *f*) Putty
- *g*) Tread stock
- *h*) Vulcanizing

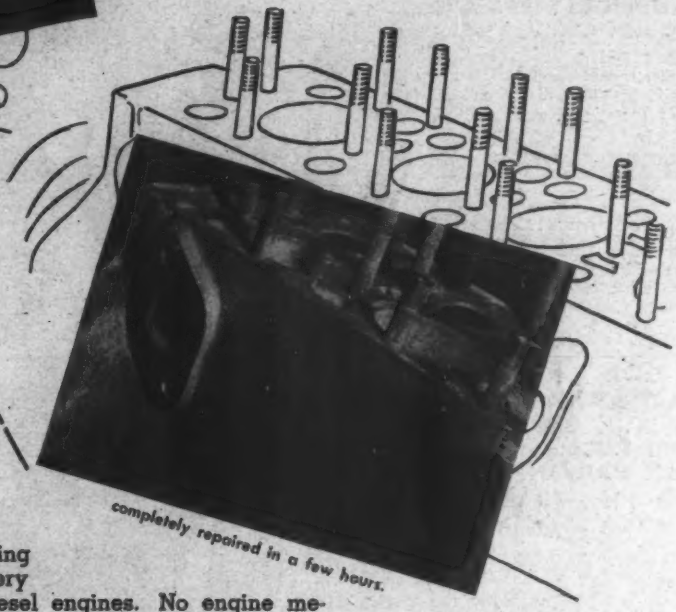
VALVE-GRINDING COMPOUND — coarse and fine
WASHERS
- *a*) Lock, assorted sizes
- *b*) Wrought iron

WASTE
WIRE — primary and secondary

K&W *Mechanical Method*

OF RESTORING CRACKED ENGINE HEADS AND BLOCKS TO UNIMPAIRED SERVICE

Cracks like this . . .



completely repaired in a few hours.

A VITAL AND HIGHLY REMUNERATIVE AUTOMOTIVE ENGINE SERVICE

The K & W Mechanical Method of repairing cracked heads and blocks is a "MUST" in every course on servicing automotive and diesel engines. No engine mechanic can be called completely "competent" in overall engine service without knowledge of this Method.

The K & W Mechanical Method employs no heat . . . it is a cold mechanical repair that will seal practically any heat, freeze or stress crack, even to the extent of affecting a complete, lasting repair on blocks broken by thrown connecting rods. Being a cold repair precludes the possibility of setting up distortion stresses such as are frequently caused by braising and welding. Furthermore, every repair made by the K & W Method is *guaranteed to last the life of the engine.*

O D T training schools teach the K & W Method, it is used regularly in the repair stations of the armed forces and is standard practice with the largest fleets, garages and engine rebuilders.

NO ADDITIONAL SHOP EQUIPMENT NECESSARY

Tools required to make K & W Mechanical repairs are the type of portable power tools that are standard equipment in practically all school shops.

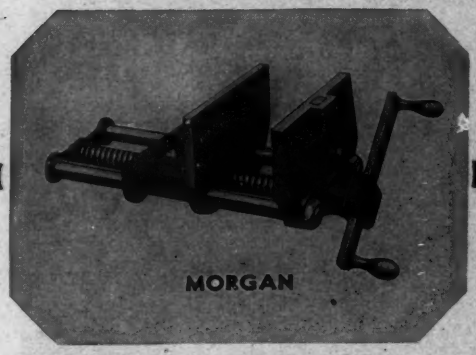
FREE TRAINING AT OUR PLANT

Complete information concerning repairs made with the K & W Mechanical Method will be furnished you; or we will train your instructors at our plant without charge.

The K & W Mechanical Method is advertised in 15 leading automotive magazines reaching automotive people everywhere. There's a K & W representative near you . . . he will be glad to give you full information. Write.

K&W KERKLING & COMPANY
BLOOMINGTON, INDIANA

Use these MORGAN VISES for Lifetime Wear



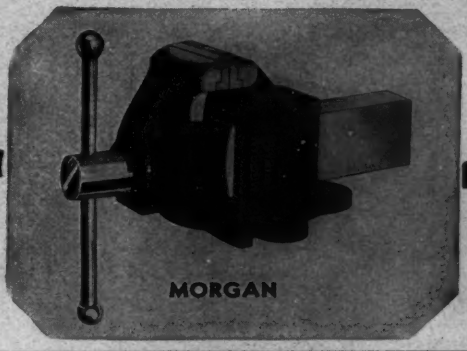
Morgan semi-steel vises give you more years of unbroken, satisfactory service. That is why thousands of school shops throughout the country are using Morgan vises as standard industrial-arts equipment. That is why, too, their shops are more economical and more efficient.

CONTINUOUS SCREW AND QUICK ACTION VISE

Designed and built to withstand the most severe service. The extra heavy Cold Rolled Screw and Solid Bronze Nut will last a lifetime.

MACHINIST VISE

Unsurpassed for strength and durability. Supplied with stationary or swivel base and in various sizes.



Write for complete information and prices

THE MORGAN VISE CO.

120 N. JEFFESSON ST. CHICAGO, ILL.

A TIME-TEACHING CLOCK PROJECT

HAROLD GLUCK and CHARLES SULLIVAN

William Howard Taft High School
New York City

There is a certain type of student who just never seems able to get started in shopwork. If we can but get him across the barrier with a finished project the resistance is broken and he turns with a will and liking toward shopwork. What is needed is a project that will fit the following educational requirements. First, it should require such a minimum of skills that there can be no valid excuse for the student not finishing the project. Second, it should be the type of work that will induce a good student to want to copy it. This is very important. Psychologically, the poor student gets a mental *lift* if he sees the other students wanting to make the same piece of work he has just finished. Third, it should be something he can use or give as a present and it should look like a job requiring difficult techniques and skills.

With this in mind, the following time-teaching clock project was devised. If the student has a younger member of his family, it will be a very welcome gift. If not, it can be given as a gift to some other young child.

In Figure 1 is shown the finished clock, painted and ready to use. To make such a clock, a ¾ by 12 by 14-in. board is required. Use either new stock or scrap. The one shown was built of scrap. Upon this board, lay off an outer circle with a radius of 5½ in., and an inner circle of 5 in. Then lay off 60 equal spaces in the space between the two circles. After the paint job is completed, insert into each dot a steel screw, each of which will represent a minute.

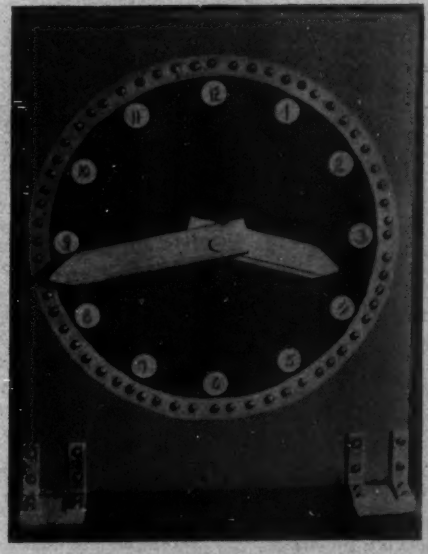


Fig. 1. The clock ready for use

Next lay off 12 marks, each one for an hour of the day, along the rim of the inner circle. Use a No. 12 auger for boring the 12 holes through the board. Get a piece of doweling ¾ in. in diameter, and cut 12 pieces each 1 in. long. These are going to be the hour numbers or hour plugs. The numbers of the hours from 1 to 12 are to be marked on these plugs. Or purchase number tacks, commonly used for identifying screens, and insert tacks from 1 to 12 into the faces of the plugs.

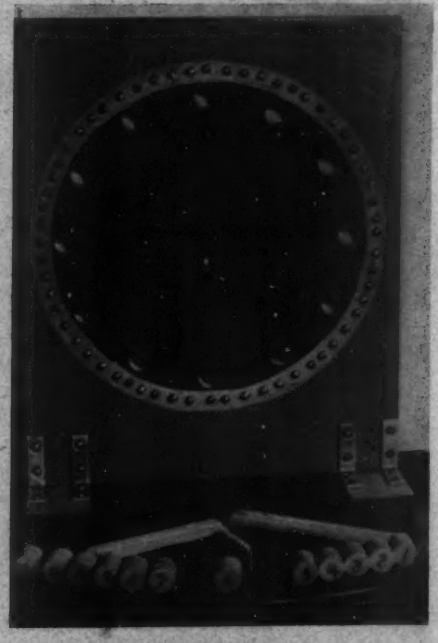


Fig. 2. The parts of the clock

For hands, use two pieces of curved molding, on one side flat, and the other side raised. Cut each to a point. The minute hand is 6 in., and the hour hand is 4½ in. long. Fasten to the center of the board with a bolt and

(Continued on page 56A)

Facing the future ..today

TODAY'S students must compete with tomorrow's conditions — with war workers trained by *modern audio-visual methods,* with returned service men who have been taught to learn rapidly and efficiently. Now it is more important than ever to make available to students the means and facilities for faster, better learning offered by Victor 16mm Sound Motion Picture Equipment and specialized films. In vocational studies, for manual training, for the sciences, social studies and general education, Victor 16mm Magic is the ideal teaching and training aid. Sturdy in construction, most simple to operate, highest in quality of sound and picture reproduction, Victor, in audio-visual education was first yesterday, is foremost today and will remain the leader tomorrow.

Insure your future
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Electrical-Shop Equipment, Supplies, Motor and Testing Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH GRINDER
BENCHES — plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably they should have electrical outlets
BITS
- *a*) Auger, ¼ in. to 1 in. by 16ths
- *b*) Auger, 11/16 in., 18 in. long
- *c*) Drill, for wood, square shank, ⅛ in. to ½ in. by 16ths
- *d*) Expansion
- *e*) Extension, 18 in.
- *f*) Screw driver, ¼ in.

BLACKBOARD — permanent or portable
BLOWTORCHES — 1-qt. size
BOOKCASE
BRACES — ratchet type, 8-in. swing
BULLETIN BOARD
CABINETS — wood or metal for filing class records, instruction sheets, drawings, etc.
CHAIRS — teacher's and tablet arm
COMPASS SAW
COIL
- *a*) Spreader
- *b*) Taper
- *c*) Winder

DESK — teacher's, with drawer compartments
DRILL
- *a*) Breast
- *b*) Concrete, ⅜ in., ½ in., ¾ in., 1 in.
- *c*) Hand
- *d*) Portable, electric
- *e*) Twist, 1/32 in. to ⅜ in. by 32nds

DRILL PRESS
- *a*) Bench, hand, or power driven
- *b*) Heavy, power driven

FILES
FIRST-AID CABINET AND SUPPLIES
HACK SAW
- *a*) Blades, 10 in., 24 tooth
- *b*) Frames, adjustable

HAMMERS
- *a*) Claw, 12 oz.
- *b*) Machinist's, ball peen

HICKEY — ½ in. and ¾ in.
LATHE
- *a*) Engine, 10-in. or 12-in. swing, 6 ft. or 8 ft. long
- *b*) Speed

PLIERS
- *a*) Gas, 6½ in. and 8 in.
- *b*) Side cutting, 6 in.

PUNCH — for metal molding
PUNCHES — assorted
REAMERS
- *a*) Pipe burring, ¼ in. to 1 in.
- *b*) Pipe burring, ½ in. to 2 in.

RULES
- *a*) 48 in. zigzag
- *b*) 72 in. zigzag

SCREW DRIVERS — 3 in., 5 in., and 8 in.
SHEARS — for cutting metal molding
SOLDER DIPPERS
SOLDERING COPPERS
- *a*) Assorted
- *b*) Electric
- *c*) Handles

STOCKS AND DIES — for pipe threads, ⅛ in. to 1 in.
VISES
- *a*) Machinist's, 4 in.
- *b*) Pipe

WRENCHES
- *a*) Adjustable, 6 in. and 8 in.
- *b*) Pipe, 10 in., 12 in., and 14 in
- *c*) Socket, combination

Electrical Shop—Supplies

ABRASIVE CLOTH — Aluminum oxide, 1, 1½, and 2 in. wide
ARMORED CABLE
- *a*) 2 wire, No. 14, single strip
- *b*) 3 wire, No. 14, single strip
- *c*) Box connectors

ATTACHMENT PLUG
BAR HANGERS
BATTERIES — dry cells
BATTERY ACID — 1.300
BATTERY SEALING COMPOUND
BOX CLEATS
BRADS — ¾ in., No. 19, and 1½ in., No. 16
BRAKE LINING — ¼ by 2 in.
BRUSHES — carbon, for motors and generators
BURGLAR CONTACTS
- *a*) Open circuit
- *b*) Closed circuit

BUSHINGS
- *a*) Loom, No. 1 and No. 2
- *b*) "Jiffy" loom No. 2

BUZZERS
CLEATS — unglazed porcelain, 2 wire
CLIPS — test, with insulators, Universal, Nos. 22, 23, 24, and 25
COMMUTATOR CEMENT
CONDUIT
- *a*) Bushings, ½ in., ¾ in., and 1 in.
- *b*) Box connectors, for flexible
- *c*) Couplings, for flexible
- *d*) Lock nuts, ½ in., ¾ in., and 1 in.
- *e*) Rigid, ½ in., ¾ in., and 1 in.

CONDULET
- *a*) Fillings, ½ in., LL, LR, and LB
- *b*) Covers, ½ in., blank

DOOR OPENERS — mortised
FISH PAPER — .0125 in. thick
FIXTURES — brass chain, suspension
FIXTURE STUDS
FUSES
- *a*) Plug type, renewable, 125 volt, 15 amp.
- *b*) Cartridge type, renewable, 125 volt, 30 amp.
- *c*) Renewals for plug fuses
- *d*) Renewals for cartridge fuses

GROUND CLAMPS — ⅛ in. to 1 in., assorted
HICKEY GRIPS — ½ in. and ¾ in.
LAMPS
- *a*) Carbon, 220 volt, 60 watt
- *b*) Mazda, selected as wattages and voltages
- *c*) Guards for brass sockets

LEATHER NAIL HEADS
LUGS — 25 and 50 amp.
LUMBER — 2 by 4 in. by 14 ft., No. 1, white pine dressed, 4 sides
MOLDING
- *a*) Metal
- *b*) Metal, fittings — crosses, T's, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches

NAILS — roofing
NUTS — iron, 4–36, 6–32, 8–32, 10–24, 12–24, 10–32, 14–20
OUTLET BOXES — 4 in. square, with one round blank cover, and one cover with bushed opening
PIPE STRAPS — galvanized, ⅜ in., ½ in., ¾ in., and 1 in.
PUSH BUTTONS
- *a*) Return call, 3 point
- *b*) Single

RECEPTACLES
- *a*) Flush, duplex
- *b*) Porcelain cleat, 660 watt, 250 volt
- *c*) Concealed
- *d*) Covers

RECTIFIERS — Tungar, for charging from 1 to 12, 6- and 12-volt batteries
RELAYS — Dixie
RESISTANCE BOARDS — for testing
RESISTANCE UNITS — 125-ohm
RHEOSTATS
- *a*) Compression, 275 watt
- *b*) Field, for shunt and compound motors

ROSETTES — wood
ROTARY CONVERTER — 5-kw. capacity, 3 phase a.c., 110 volt d.c.
SCREWS
- *a*) Anchors, 8/32, 10/24, 12/24, 14/20
- *b*) Machine, roundhead, 4–36 by ¼ in., 6–32 by ½ in., 6–32 by ¾ in., 8–32 by ⅜ in., 8–32 by ½ in., 8–32 by 1 in., 10–32 by ⅜ in., 10–24 by ⅜ in., 10–24 by ¾ in., 10–32 by ¾ in., 12–24 by 1 in.
- *c*) Machine, brass, roundhead, 4–36 by ¼ in., 6–32 by ½ in., 6–32 by ¾ in., 8–32 by ½ in.
- *d*) Wood, flathead bright, No. 5 by ¾ in., No. 8 by ½ in., No. 8 by ¾ in., No. 8 by 1 in., No. 7 by 1½ in., No. 8 by 1½ in., No. 7 by 2 in.
- *e*) Wood, roundhead blued, No. 7 by 1 in., No. 8 by 1½ in., No. 10 by 1½ in., No. 7 by 2 in.

SLEEVING — No. 1, white; No. 1, blue; and No. 1, red
SOCKETS
- *a*) Brushed, brass pull chain, keyless, key
- *b*) Porcelain, keyless, with caps
- *c*) Porcelain, key, with caps

SOCKET CAPS — ¼ in. and ⅜ in. bushed
SOLDER WIRE — 50/50, size No. 10
SOLDERING PASTE — 2-oz. cans, noncorrosive
SOLDERING SALTS — 1-oz. cans, noncorrosive
SPEED COUNTERS — 0–9999
SPLIT KNOBS — porcelain
SPRING BALANCES — 0–30 lb.

(Continued on page 54A)

PAYMENT TO VETERANS TAKING PART-TIME STUDIES

Payments to veterans for part-time studies and to institutions for part-time students under the educational features of the "G.I. Bill of Rights" were established today in instructions issued by Brig. Gen. Frank T. Hines, Administrator of Veterans' Affairs.

All veterans who have not been receiving checks because they are taking part-time courses will go on the pay roll immediately, unless they are gainfully employed in full-time jobs not related to the course of training. In this case no payments will be made.

General Hines' letter provides for payments to both veterans and institutions in proportion to the time the veteran devotes to the educational or training program. But the time the veteran may follow a part-time course will be increased so that he may receive the equivalent of the maximum full-time course permitted by law.

That is, if a veteran is going to school half time, he will be paid at half the full-time rate, but he may continue the course twice as long, as he is using up his allotment at only half the rate he would under a full-time course. Of course, he may not continue his course beyond the maximum permitted by law.

The schedule provides for payments in schools using semester hours as follows:

12 hours — full time
9 to 12 hours — ¾ time
6 to 9 hours — ½ time
3 to 6 hours — ¼ time

In schools using clock hours the schedule follows:

25 hours per week — full time
18 to 25 hours per week — ¾ time
12 to 18 hours per week — ½ time
6 to 12 hours per week — ¼ time

For on-the-job training the schedule is based on the number of hours a student is required to devote to training. As these are not uniform they will be based on schedules submitted by the institution in which the training is undertaken. But both time on the job and time spent in doing related schoolwork will be used in estimating the payments to be made.

However, the basic schedule provides:

36 hours or over per week — full time
27 to 36 hours per week — ¾ time
18 to 27 hours per week — ½ time
9 to 18 hours per week — ¼ time

For those doing graduate work the policy of the institution will prevail and a statement from a responsible official will determine what

(Continued on page 58A)

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GENERAL ELECTRIC EDUCATIONAL SERVICE

Because of the utilization of our facilities for war work, the War Production Board priority requirements may make it impossible for us to make the deliveries you desire. However, there are no priorities on plans for your future needs.

Motion-picture Films

An extensive motion-picture service is maintained by the General Electric Company for the purpose of disseminating throughout the United States reliable information concerning important developments in the electrical field.

The service provides motion-picture films by means of which the details of manufacture and the use of electric products are presented in a highly instructive manner.

Silent pictures are furnished either in 35-mm, safety or nitrate stock, and 16-mm safety stock.

All sound pictures are available in 16-mm sound on film, safety base. Many are also available in 35-mm size. Films are lent free of charge with transportation charges paid by user.

These films are listed and described in General Electric's motion-picture catalog, GES-402, copies of which may be had upon application to the nearest G-E office. Requests for the use of motion-picture films should be addressed as directed in that publication and will receive the attention of a specialist.

Photo News Service

General Electric furnishes more than 10,000 school and college teachers in this country and abroad with semimonthly news posters which tell briefly, authoritatively, and interestingly the story of the accomplishments of electricity — the most recent developments in the research laboratories of the Company — experiments with man-made lightning — electric ships, spectacular lightning, precision instruments, short-wave radio, X ray. These posters have come to be almost standard equipment for many general-science teachers. They are published on the 1st and 15th of every month from October 1 through June 15. The service is free. Teachers only should apply for it, and should give their school address.

Educational Construction Projects

The General Electric Company, in carrying out its educational program, has sponsored the preparation and publication of several construction projects for technical and vocational schools. These projects are exceptionally valuable for the school shop since they are not merely assembly projects, but involve a certain amount of mechanical dexterity with such tools as the lathe, drill press, tap and die, etc. The G-E projects have the following standard ratings and are completely described in the G-E bulletins indicated:

(1) ¼-hp, single-phase, 60-cycle, 110-volt capacitor-motor, GEA-3514.

(2) ½-hp, single-phase, 60-cycle, 115/230-volt capacitor-motor, GEA-3528.

(3) ½-hp, 3-phase, 60 cycle, 220-volt motor, GEA-3542.

(4) 250-watt, 125-volt, compound-wound d-c generator, GEA-2289.

(5) 1½-kva, 220-55/110-volt, 60-cycle air-cooled transformer, GET-569.

Equipment for Electric-machinery and Electronics Laboratories

When deciding on the equipment for an electrical shop or laboratory, the new Bulletin GED-1093 will be particularly useful. In this publication will be found equipment listed in several groups to meet a wide range of requirements. For the elementary courses, a few of the more important types of machines are recommended, together with control apparatus, measuring instruments, and certain machine tools which should be in every electrical shop. For more advanced work, or as funds become available, equipment from other groups may be added to provide well-balanced laboratory equipment which will permit a wide range of experiments.

In addition to listing the equipment, this booklet discusses briefly the several items, explaining why they have been selected and the use to which they may be put in the laboratory.

This bulletin, which supersedes GEB-62, has been completely revised and brought up to date. The section covering electronics-laboratory equipment is especially recommended to those who are planning a laboratory for the study of the basic principles of electronics and electronic control.

LABORATORY APPARATUS

General Electric engineers will gladly recommend apparatus to meet your special conditions if you will give them such details as: type of course, number of students, laboratory or shop space available, money at hand for equipment, etc. Further than this, liberal discounts from the regular commercial prices of Company products are allowed to educational institutions. For quotations on apparatus and further information concerning G-E educational service, consult the Educational Specialist at the nearest office of the Company, or write direct to our Educational Sales Section at Schenectady.

Usually, the General Electric Company recommends standard apparatus for laboratory instruction. It is recognized, however, that because of its size, cost, and the power required for operation, much commercial apparatus cannot be used in the laboratories of engineering schools and colleges. For this reason, the General Electric Company has given especial attention to the selection for educational use of such standard apparatus as is of suitable size and which will illustrate fundamental principles of design and construction as well as acceptable commercial practice.

Where standard apparatus is not entirely suitable, the General Electric Company has not hesitated to design special apparatus for the electrical laboratory and shop.

Thus the student is given an opportunity, while becoming familiar with the underlying principles of electrical engineering, to become acquainted with actual construction details. Bulletin GEA-1185 illustrates and describes G-E apparatus particularly adapted for laboratory use.

Other G-E- Publications

Catalogs, descriptive bulletins, and other publications are available covering practically all standard lines of G-E apparatus, such as electric motors and generators, control equipment, instruments, transformers, etc. For such bulletins and for complete information regarding any electric equipment in which you are interested, address the Educational Specialist at the nearest G-E office.

GENERAL ELECTRIC

General Office, Schenectady, N. Y. — Apparatus Sales Offices in Principal Cities

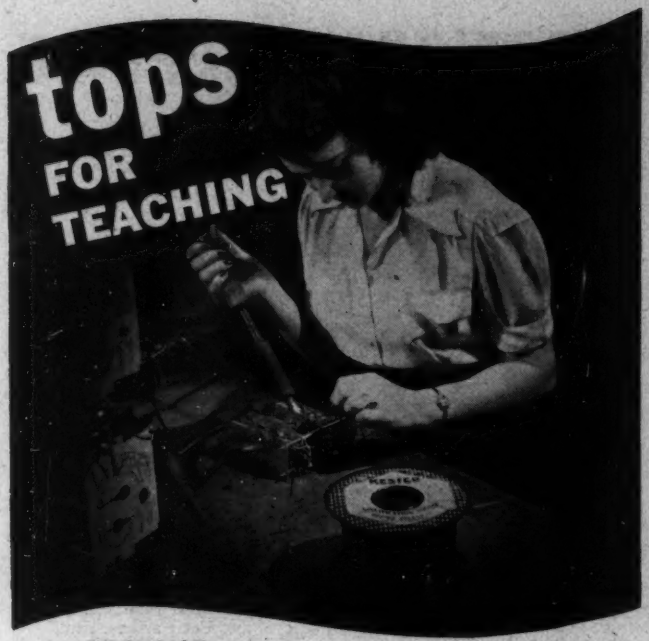


Photo Courtesy The Hallicrafters Co.

BECAUSE

Laboratory-Perfected for Industry

KESTER CORED SOLDERS

- Kester Cored Solders are tops for teaching because they're the standard, modern solders of American industry.
- Another reason is that they are virtually mistake-proof in application, because positive-acting flux — flux that does not disintegrate or lose its fluxing power — is right in their cores. They're laboratory-perfected to form solder-bonds that hold fast under the most severe operating conditions.
- A third reason is that the flux and solder are applied in one quick, simple operation. Messy flux pots are out. Waste is avoided. Flux splatters on walls, floor and benches are eliminated.
- Your students will use Kester Cored Solders when they take soldering jobs. They will use *Kester Rosin-Core Solder* for electrical work, and *Kester Acid-Core Solder* for general work. Experience *now* will help them *then*.
- Prep your students on the clean, tight bonds that Kester Cored Solders form. Acquaint them with the complete Kester line, that includes a strand and core size, and alloy and flux combination, for every kind of solder job. You'll be proud of their student work.
- Your classroom solder is laboratory-perfected for industry when you teach with Kester Cored Solders; and 46 years' solder experience and laboratory research back your teaching. Order from your wholesaler.

★ BUY WAR BONDS ★

KESTER SOLDER COMPANY

4257 Wrightwood Avenue, Chicago 39, Illinois

Eastern Plant: Newark, N. J. Canadian Plant: Brantford, Ont.

KESTER
FLUX-FILLED SOLDER

(Continued from page 52A)

STARTING BOXES
- *a*) For compound motors, various makes
- *b*) For shunt wound, 1 h.p., 110-volt motors. Overload release
- *c*) For shunt wound, 1 h.p., 110-volt motors. No voltage release
- *d*) Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt a.c. motors

STORAGE BATTERIES — 6 volt

SWITCH
- *a*) Battery, 4 point
- *b*) Bases, porcelain, for 10-amp. switches
- *c*) Boxes, 2¾ in. deep
- *d*) Entrance, safety, 2 pole, 30 amp., with 2-branch lighting circuits
- *e*) Entrance, safety, 3 pole, 30 amp., 250 volt
- *f*) Flush, push button, S.P., D.P., 3 way, 4 way
- *g*) Surface, S1, S3, and S4
- *h*) Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T.
- *i*) Surface, snap, electrolier
- *k*) Surface, snap, S.P.D.P., 3 way, 4 way

SWITCHBOARD — as required

TACKS — double-pointed No. 10

TAPE
- *a*) Friction, ½-lb. rolls
- *b*) Rubber, ½-lb. rolls

TELEGRAPH SETS — including sounders, keys, and relays

TELEPHONES
- *a*) Complete bridging, independent phones
- *b*) Couch vestibule telephones
- *c*) Receivers, transmitters, induction coils, condensers, and bridging switch hooks

TRANSFORMERS
- *a*) Bell ringing, 6, 8, 14 volt
- *b*) Single phase, 110–220 volt, S.K.V.A.

TUBES — porcelain, 5/16 by 3 in., 5/16 by 5 in., and 5/16 by 10 in.

TUBING — flexible nonmetallic, ¼ in. and ⅜ in.

WASHERS
- *a*) Iron, ¼ in. and ⅜ in.
- *b*) Brass, ¼ in. and ⅜ in.

WIRE
- *a*) Annunciator No. 18 or No. 20
- *b*) Fixture, No. 18, single yellow, with marker
- *c*) Rubber covered, solid copper, No. 10, black
- *d*) No. 10, white
- *e*) No. 14, black
- *f*) No. 14, white
- *g*) Rubber covered, No. 16, brewery cord
- *h*) No. 18, lamp cord, green and yellow
- *i*) S.C.C. copper magnet, enameled, sizes Nos. 16 to 26 inclusive

Electrical Shop—
Motor and Testing Equipment

ANNUNCIATORS
- *a*) Automatic needle drop
- *b*) Gravity drop
- *c*) Manual needle drop

ARMATURES — burnt out, for repairing

BATTERY CHARGER — commercial

CIRCUIT BREAKERS
- *a*) Air, single pole, overload, 25 amp., 550 volt
- *b*) Air, single pole, underload, 15 amp., 550 volt

CONTROLLERS
- *a*) For multiple-speed motor
- *b*) For 1 h.p., 110-volt series motors

GENERATORS
- *a*) Motor-generator set, 10 h.p., to supply 110-volt d.c. for testing purposes, battery charging, etc.
- *b*) Generator, 6-volt d.c. coupled to an a.c. motor for 6-volt circuit testing
- *c*) Auto generators of different makes

GRAVITY CELLS

MAGNETS — testing, 10,000 ohm

METERS
- *a*) Ammeter, standard, 60 amp., a.c.
- *b*) Ammeter, standard, 60 amp., d.c.
- *c*) Ammeter, student, 60 amp., a.c.
- *d*) Ammeter, student, 60 amp., d.c.
- *e*) Voltmeter, standard, 0–10 volt,
- *f*) Voltmeter, standard, 110–220 volt, d.c.–a.c.
- *g*) Voltmeter, standard, 125 volt, a.c.
- *h*) Voltmeter, standard, 125 volt, d.c.
- *i*) Voltmeter, student, 110 volt, d.c.
- *k*) Voltmeter, student, 110 volt, a.c.
- *l*) Wattmeter, standard, 110–220 volt, 30–60 amp., d.c.–a.c.
- *m*) Wattmeter, student, 110–220 volt, 30 amp., a.c.–d.c.
- *n*) Watt-hour meter, 125 volt, 5 amp., a.c., single phase, various makes

MOTORS
- *a*) Auto starter, different makes
- *b*) Burnt out, fractional h.p., 110 volt, 60 cycle, for repairing
- *c*) Compound, 1 h.p., 110 volt, d.c.
- *d*) Multiple speed, 1 h.p., 3 phase, 220 volt
- *e*) Series, 1 h.p., 110 volt, d.c.
- *f*) Shunt, 1 h.p., 110 volt, d.c.
- *g*) Split phase and repulsive, a.c., 110 volt, single phase, assorted
- *h*) Split phase induction motors, fractional h.p., 110 volt, 60 cycle, different makes
- *i*) 3 phase, 1 h.p., a.c., 220 volt, various makes
- *k*) 3 phase, 2 h.p., 220 volt, a.c., various makes
- *l*) Universal, fractional h.p., 110 volt, different makes
- *m*) Universal, variable speed, ⅓ h.p.

PLATFORM SCALE — 100 lb. capacity

The World's STANDARDS OF ACCURACY

for Instruction, Research, Industry

The widespread use of WESTON instruments in vocational education has become a fixed principle...primarily because these are the measurement standards so widely used throughout industry. Thus the student becomes thoroughly familiar with the instruments he will use throughout his industrial career. They are preferred, too, because they inspire students to be more exacting in their work, and because they represent a truly sound investment...combining ruggedness, dependability and long life.

Following is a condensed listing of the WESTON instruments available . . . also are illustrated a few of the models most widely used in educational work. Complete information on any WESTON instrument is available and will gladly be sent on request. Write to... Weston Electrical Instrument Corporation, 595 Frelinghuysen Avenue, Newark, New Jersey.

PORTABLE INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

PANEL MOUNTING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

RELAYS
Sensitive and Power Uses — Current and Voltage Types

INSTRUMENT TRANSFORMERS
Portable — Potential and Current

AIRCRAFT INSTRUMENTS
Tachometers, Temperature Indicators, Radio Compass Indicators, Ammeters, Voltmeters, etc.

ELECTRIC TACHOMETERS
A.C. and D.C. Types — Remote Indicating

LABORATORY STANDARDS
Voltmeters, Ammeters, Wattmeters

SPECIALIZED TESTING EQUIPMENT
Power Analyzer, Photoelectric Potentiometer, Battery Testing Instruments

SERVICE EQUIPMENT
Tubecheckers, Analyzers, Ohmmeters

PHOTOELECTRIC CELLS
"Photronic" Cells — Dry Disc Type

PHOTOELECTRIC CONTROL DEVICES
"*Photronic" Cell Controls, Illumination Controls

LIGHT MEASURING DEVICES
Illumination Meter, Foot Candle Meters. Sight Meter, Exposure Meters

TEMPERATURE INDICATING INSTRUMENTS
ELECTRICAL TYPE — Remote Indicating
BIMETALLIC DIAL TYPE — Laboratory, Industrial

INSTRUMENT ACCESSORIES AND PARTS
Shunts, Cables, Resistors, Switches, Binding Posts, Leads, Multipliers, Adapters, Radio Plugs, etc.

STANDARD CELLS

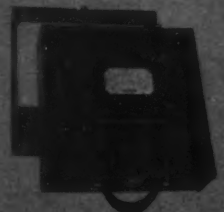
**Photronic — A registered trademark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.*

Model 45
D. C. Instruments

Sturdy portable test instruments for accurate testing. Magnetically shielded, polished hardwood case. Accuracy ½ of 1%. Hand calibrated mirror scales of long length. Available in Voltmeters, Ammeters, Milliammeters, Volt-Ammeters.

Model 430
Portable, Precision A. C. and D. C. Instruments

Universally used in schools and industry wherever rugged, portable instruments are required for general testing. Hand calibrated, mirror scales with knife-edged pointers.



Model 785
Industrial Circuit Tester

Provides 27 ranges . . . all the ranges necessary for voltage, current and resistance measurements in signal, control and electronic circuits, or wherever else high sensitivity is a factor.

Model 489 and 528
Lowell A. C. and D. C. Instruments

Small, sturdy, inexpensive . . . for all-around A.C. and D.C. testing where moderate accuracy is sufficient. Available in Voltmeters, Ammeters, Milliammeters. A.C. models available in single, double and triple ranges.

Model 155
A. C. Instruments

Single or multi-range instruments, movable iron type, for general testing where high accuracy and long scale length are desired. Ammeters available with ranges up to 500 amperes, self-contained; Voltmeters up to 750 volts, self-contained. Sturdy, hardwood cases.

Model 633
A. C. Clamp Ammeter

Current readings obtained simply by placing clamping jaws around conductor. Circuits never disturbed. 6 current ranges. High insulation for complete protection.

Model 772
Super-Sensitive Radio Set Tester

Sensitivity of 20,000 ohms per volt. Adequate voltage, current, resistance and output meter readings for servicing receivers, transmitters, P. A. systems, vacuum and cathode ray tube equipment, communications circuits, etc.

WESTON *Instruments*

TRAINING in SHEET-METAL WORK

for today's immediate needs . . and tomorrow's opportunities

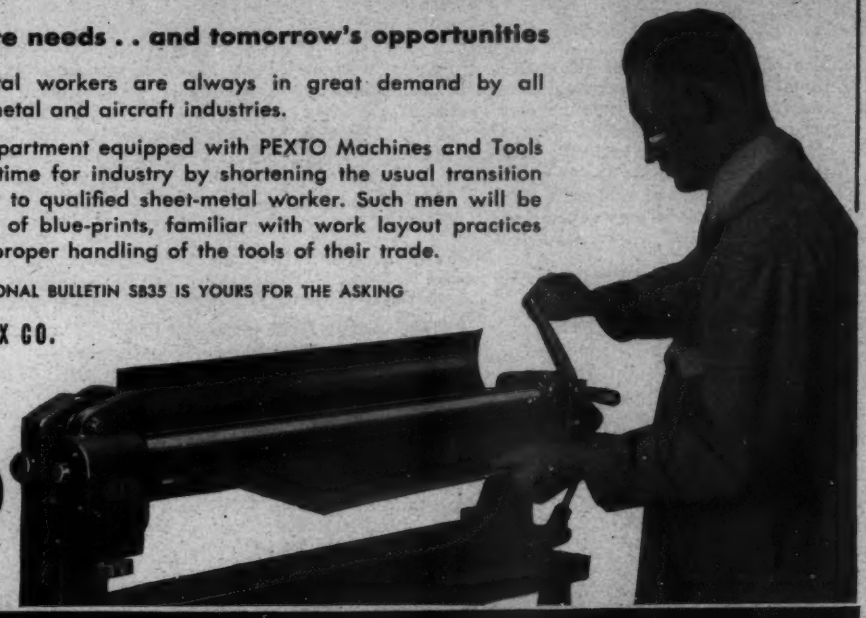
Skilled sheet-metal workers are always in great demand by all branches of sheet-metal and aircraft industries.

A sheet-metal department equipped with PEXTO Machines and Tools will gain valuable time for industry by shortening the usual transition period from learner to qualified sheet-metal worker. Such men will be schooled in the use of blue-prints, familiar with work layout practices and trained in the proper handling of the tools of their trade.

VOCATIONAL BULLETIN SB35 IS YOURS FOR THE ASKING

THE PECK, STOW & WILCOX CO.
Southington, Connecticut

PEXTO
SINCE 1885



SHEET-METAL WORKING Machines and Tools

TIME-TEACHING CLOCK

(Continued from page 50A)

nut. These hands can be moved to show the time.

The clock needs a good but simple base support. Get two pieces of ¾ by 2 by 6-in.

Fig. 3. Playing the game

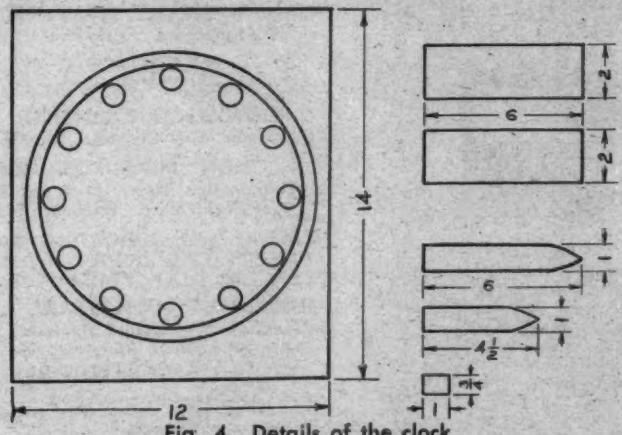


Fig. 4. Details of the clock

board. These will support the clock face by means of metal angles. Attach angles on *both* sides of the clock. However, in order that the screws do not meet, on the clock side the angles are separate, but on the reverse side they are together in the center of the base board.

Use either enamel or a good paint to finish the board. In Figure 2 you have the clock face, the hands off the clock on the table, and the 12 number plugs. Figure 3 shows a youngster inserting a time plug in the appropriate hole.

Get your student to work out directions on how the toy is to be used. Here you get into contact with the student. For whom is it being built? A younger brother or sister? A neighbor's child? A fond nephew? Point out that with very young children, the time-teaching clocks can be played like a game. The game consists first in placing the correct number into the correct hole. Then you move the hands and the child must tell the time. With older children it can be used as a direct teaching aid. The hands are moved into different positions. Later, the numbers are removed and the child is able to tell the time without use of the numbers by position of the hands. Time should be taught first in terms of minutes as 1:20 or 1:15 and then in terms of quarter and half hours. Directions should be typewritten or printed by hand in script.

During the Christmas season, this project can be turned into a complete show project and a number of them made for one of the local charity organizations or toy distributing groups.

Our farm woodlands alone have a larger area than the combined forests of Norway, Sweden, Finland, and Italy.— *American Forest Products Industries, Inc., Washington, D. C.*

Machine Operator—Or Machinist?

Help Him Select The Right Road with WALKER-TURNER MACHINE TOOLS

In order to meet the tremendous demands of war, Industry has been compelled to train and use thousands of **machine operators.** But in peacetime, Industry's prime need will be for more thoroughly-trained **machinists.** To meet that demand, your students need the broad, basic training offered by Walker-Turner Machine Tools.

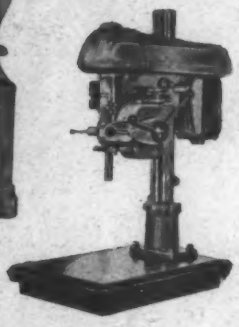
These machines help the trainee learn differences in materials . . . because they machine everything from tool steel to plastics. Their exceptionally wide speed ranges fit them for a variety of cutting speed problems. Their flexibility enables your students to develop innumerable special set-ups. And they handle practically every machining operation . . . drilling, tapping, sawing, reaming, milling, counter-boring, and lots more.

Safely and simply operated, Walker-Turner Machine Tools give industrially job-tested performance at prices to fit your budget. Send for our latest catalog.

WALKER-TURNER CO., INC., 5493 Berckman St., Plainfield, N. J.

BAND SAWS

● 14 in. and 16 in. models. Back gearing and cone pulleys provide speed range from 61 to 5300 s.f.m. for cutting practically any material from steel to wood.



20-INCH DRILL PRESSES

● Power or hand feed. Drill to center of 20" circle. Feed 6". Capacity 1" in cast iron, ¾" in steel. Spindle speeds 260-5200 r.p.m.

RADIAL DRILL

● Handles light drilling, tapping and routing operations as effectively as larger machines. Drills to center of 62" circle. Maximum distance nose of chuck to table, 13½". Spindle traverse, 3¼".

walker-turner COMPANY, INC. PLAINFIELD, N.J. U.S.A.

E1

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

HOW BERNARD PARALLEL ACTION TOOLS give "More POWER to You!"

1. Parallel jaws exert even pressure over entire length.
2. Compound leverage gives great cutting power.
3. Parallel jaws hold objects without "wedging".

SEND FOR CATALOG
Address: School Supply Division
THE WM. SCHOLLHORN CO.
NEW HAVEN, CONN.
Serving Industry for over 75 Years

GREAT INVENTOR DIES

(Continued from page 46A)

degree of mechanical engineer from Cornell University in 1911.

Dr. Thomas Midgley, Jr.

After his graduation he entered the employ of the National Cash Register Company, Dayton, Ohio. Later he was associated with his father in the Midgley Tire and Rubber Company of Lancaster, Ohio. In 1916, he returned to Dayton and began work under Charles F. Kettering.

When Dr. Kettering moved to General Motors he took Dr. Midgley with him — and also the researches into antiknock compounds in which he and T. A. Boyd were engaged at the time. From the discovery of tetraethyl lead as an antiknock agent came the formation of the Ethyl Corporation in 1924 with Dr. Midgley serving as its first vice-president. His Freon refrigerants gave rise to Kinetic Chemicals, Inc. He held several important patents and he contributed many technical papers to magazines.

PAYMENT TO VETERANS

(Continued from page 52A)

proportion of time is being consumed by the veteran's courses.

General Hines' letter also provides that where unusual circumstances exist that are not covered by his instructions they shall be referred to the Central Office of the Veterans Administration, together with a complete statement of the facts, so they may be considered there.

The task of vocational education is bound to be multiplied during the period of readjustment following the present war. What the schools have done in the period devoted to defense training and the training of warworkers since July, 1940, can be repeated in a more difficult job provided the schools are adequately financed to meet the emergency. Even in Delaware with a total school population of only about 50,000 more than 37,000 persons have received special training for war jobs in this period. Given adequate funds the American schools can do any kind of a job that America needs to have done in the way of educating either her children or her adults. — *H. V. Holloway.*

VOCATIONAL Misfits are OUT TODAY!

Hit-or-miss projects have no place in modern vocational training programs . . . therefore EVERY FELLOWCRAFTERS' PROJECT IS THOROUGHLY ANALYZED AND TRIED OUT BEFORE WE OFFER IT. SHOP-TESTED CRAFTS, TAILORED TO MEASURE FOR ALL AGE GROUPS AND CLASS NEEDS.

LEATHERCRAFT PROJECTS

No. 311-A. Billfold. With identification window, 2 card pockets; 4½"x3¼" closed. El Morocco Tooling Sheepskin with gimp lacing. Ea. 60¢; doz. $6.60

No. 316-A. 6-Hook Key Case. Another smart project; El Morocco Tooling Sheepskin, card pocket, gimp lacing. Ea. 45¢; doz. $4.95

14th Catalog — Free on Request

See Fellowcrafters new 56-page illustrated Catalogue for real vocational guidance data in Plastics, Metals, and 20 other crafts, with Priority Data.

DISTRIBUTORS:

ATLANTA 1, GA., Milton Bradley Co. of Ga., Inc., 384 Forrest Ave., N. E.
BOISE, IDAHO, The Book Shop, 319 N. 8th St.
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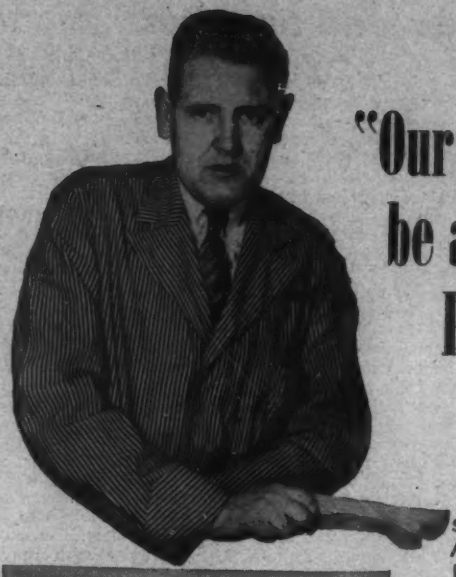
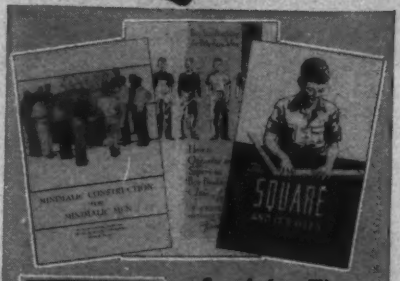
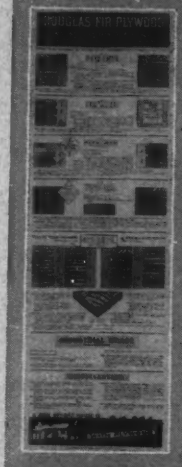


"Our woodworking classes would be at a loss without Douglas Fir Plywood;

—and now we feel the same way about the pamphlets and wall charts you have advertised."

says Marcus E. Erickson of the Augusta Lewis Troup, Junior High School, New Haven, Connecticut.





Send for These Free Booklets--and the Douglas Fir Plywood Wall Chart

"The Square and Its Uses"

"Minimalic Construction for Minimalic Men"

"How to Organize and Supervise Boy Builders' Clubs"

These three booklets, available without charge, will prove both helpful and stimulating. The Wall Chart provides a complete resume of Douglas fir plywood grades, stock sizes and uses.

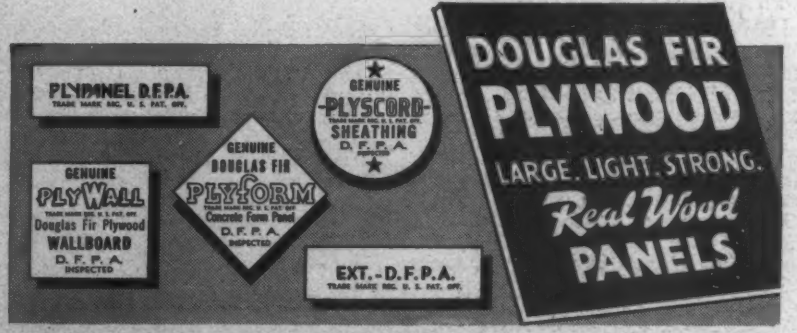
Also available for classroom showing are six color-and-sound movies. Write for pamphlet describing them.

DOUGLAS FIR PLYWOOD ASSOCIATION

Tacoma 2, Washington

When Douglas fir plywood is again available (which will be the moment war restrictions are lifted) give **your** classes the advantages offered by this modern "miracle wood". Douglas fir plywood is an ideal material for student instruction, just as Mr. Erickson says. It's light in weight, strong, rigid and durable. It's easy to work, either by hand or with power tools. It holds nails or screws right at the edge without cracking or splitting. It takes any finish, easily and quickly. In short, it makes possible a stronger, better-looking finished project—one which gives students that feeling of accomplishment which is so important.

Lay your plans now. Remember, when restrictions are lifted, plywood will be immediately available. The plywood industry faces no reconversion delays.


PLYMINEL D.F.P.A.
GENUINE -PLYSCORD- SHEATHING D.F.P.A.
GENUINE PLYWALL Douglas Fir Plywood WALLBOARD D.F.P.A. INSPECTED
GENUINE DOUGLAS FIR PLYFORM Concrete Form Panel D.F.P.A. INSPECTED
EXT.-D.F.P.A.
DOUGLAS FIR PLYWOOD
LARGE. LIGHT. STRONG.
Real Wood PANELS

SPECIFY DOUGLAS FIR PLYWOOD BY THESE "GRADE TRADE-MARKS"

Woodworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH
- *a*) Shop, with hardwood tops, 1¾ in. or over in thickness, the top to project far enough to allow a rapid-acting or continuous-screw vise to be attached.
  It may be well to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type
- *b*) Glue
- *c*) Stain, with metal-covered top
- *d*) Teacher's demonstration

BLACKBOARD — permanent or portable
BOOKCASE
BULLETIN BOARD
CABINETS — wood or metal for filing class records, instruction sheets, drawings, finishing materials, hardware, small tools, supplies, etc.
CHAIRS — teacher's and tablet arm
CORE OVEN — for patternmaking class
DESK — teacher's, with drawer compartments
FURNACE — for melting soft metals (for patternmaking class)
GLUEPOT — 1 qt. or 2 qt., electric, gas, or steam heat
GLUE WARMER OR COOKER — 1- to 5-gal. capacity
GRINDER
- *a*) Automatic knife, direct-motor-type. Size to suit largest knife used in school shop, complete with water pump, grinding wheel, and automatic stops
- *b*) Bench, hand or power
- *c*) Bench, motor-in-head. Motor bearings to be completely housed, wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel
- *d*) Revolving oilstone, pedestal type, with one fine and one coarse oilstone

JOINTER
- *a*) 6-in. or 8-in. portable jointer. Table to be fitted for rabbetting. Safety-cylinder type, equipped with safety guard
- *b*) 12, 16, or 18 in. direct motor drive, ball bearing. Cylinder to be of safety-head type. Table to be fitted for rabbetting. Jointer to be equipped with safety guard

LATHES
- *a*) 6-in. to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24, 36, 48, 60, or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block
- *b*) Patternmakers', with end faceplate provision. Lathe to be of direct-motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class)

MORTISER
- *a*) Direct-motor-drive, or belt-driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod
- *b*) Portable, vertical, hollow-chisel mortiser, bench type

PLANER — 12, 18, 20, 24, or 30-in., motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife-setting and jointing device complete with bar should be mounted on machine if possible
SANDER
- *a*) Belt, direct motor drive
- *b*) Disk, motor or belt driven
- *c*) Oscillating spindle, motor driven
- *d*) Portable, hand-plane type, direct motor drive
- *e*) Vertical spindle and disk sander

SAWS
- *a*) Band saw, 20 to 36 in., motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.
- *b*) Combination, band saw, crosscut saw, ripsaw, and mortiser. Machine to be completely guarded
- *c*) Cutoff, pedestal or swing type to be fitted with 12-in. to 16-in. saw
- *d*) Filing machine, direct motor drive
- *e*) Jig, direct motor or belt driven
- *f*) Portable band saw, 14 to 20 in. ball bearing, motor driven
- *g*) Saw bench, directly connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided
- *h*) Universal saw bench, 14 to 16 in., motor driven
- *i*) Variety saw bench, motor driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly. The saw is to be equipped with ripping fence and miter cutoff gauges

SHAPER
- *a*) Motor drive, single or double spindle. Table to be equipped with removable center plate
- *b*) Portable shaper or router with a suitable selection of cutters

TENONER — single end, with coping heads and cutoff saw
VISES — rapid-acting or solid-nut type woodworking-bench vises, 7 to 10 in.
WOOD TRIMMERS — complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings (for patternmaking class)

Woodworking—Small Tools

AWLS — brad, assorted sizes
BEVELS
- *a*) Protractor
- *b*) Sliding T, 8 in.

BITS
- *a*) Auger, 3/16 in. to 1 in. inclusive, by 16ths
- *b*) Auger, 3/16 in. to ½ in. inclusive, by 16ths
- *c*) Braces, ratchet type, 8-, 10-, 12-, or 14-in. sweep
- *d*) Countersink, for wood, rose pattern, ½ in. and ⅝ in.
- *e*) Dowel, square shank, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.
- *f*) Expansive, ⅞ in. to 1½ in.
- *g*) Expansive, ⅞ in. to 3 in.
- *h*) Forstner, square shank, ¼ in. to ½ in. inclusive, by 16ths
- *i*) Screw driver, square shank, ¼ in., 5/16 in., ⅜ in.
- *k*) Twist drill for wood, square shank, 1/16 in. to ⅜ in. inclusive, by 16ths
- *l*) Twist drill, straight shank, 1/16 in. to ⅜ in., inclusive, by 32nds

BLOWTORCH
BROOMS
BRUSHES
- *a*) Bench duster, 10 in.
- *b*) Floor
- *c*) Glue, round, 1½ in. and ¾ in.
- *d*) Glue, round, 1½ in.
- *e*) Marking, camel's hair, No. 1 and No. 2
- *f*) Varnish, flowing, 2 in. and 2½ in.
- *g*) Varnish, flat, ½ in., ¾ in., and 1 in.

BURNISHERS — oval or round
CAN OPENER
CARVING TOOLS
- *a*) Sets containing 6 tools
- *b*) Sets containing 12 tools

CHISELS
- *a*) Cold, machinists', ⅜ in. and ½ in.
- *b*) Mortising chisel and bits, ¼ in. to ½ in. by 16ths
- *c*) Socket firmer, bevel edge, ⅛ in., ¼ in., ½ in., ¾ in., 1 in., and 1½ in.

(Continued on page 62A)

PREINDUCTION TRAINING

Captain John R. Rackley, Chief, Preinduction Branch, School Division, Headquarters, Seventh Service Command, Army Service Forces, Omaha 2, Neb., advises boys to stay in school, and shape their learning so that it will be helpful for entry into the army as well as for entry into their future home, community, business, and occupational life.

Out of their *academic work* at school he advises them to get (*a*) the best method of learning, (*b*) the ability to use the mind as a resourceful tool, and (*c*) a desirable amount of basic knowledge that can be used at any time.

Their *industrial arts and vocational* work should give them as many skills as possible. Soldiers need a background of mechanical experience because in the army they must operate, maintain, and repair much mechanical equipment.

Through their *physical and health training*, they should develop endurance, co-ordination, and alertness, all qualities that will make for success in both everyday and army life.

Then, too, every boy should learn what to expect when he enters the army, why we are at war, what issues are involved, and how the different branches of our armed service co-ordinate in the all-out war in which our country is engaged.

SAFE WINTER DRIVING

The following practices, based on National Safety Council research, are recommended "winter rules for auto pools" or all who must drive this winter:

1. If you must drive this winter, fill your car to comfortable capacity and go prepared to get through, regardless of snow or ice.

2. Reduce your speed to conform to the conditions of the road — and take no chances.

3. Use tire chains on ice and snow to reduce braking distances as much as 40 or 50 per cent. Chains also provide necessary "go" traction and uniformity in performance under severe winter road conditions.

4. Follow other vehicles at a safe distance. It takes from 3 to 11 times as long to stop without antiskid chains when pavements are snowy or icy.

5. Apply brakes on slippery pavements lightly and with a pumping action. If you jam on the brakes, they may lock and throw your car into a dangerous skid. Try to avoid need for making a quick stop in front of another vehicle. A rear-end collision may cripple your car for the duration.

6. Keep windshield and windows clear of snow and ice outside, and fog and frost inside. Remember, you must see danger to avoid it.

7. Keep posted on winter road and weather conditions. A safe driver is always aware of his limitations and equipped to get through safely and on time. Be a good defensive driver.

Manual Training Instructors tell us that they strongly emphasize the close relationship between well-finished work and good tools. And many of them illustrate this important lesson with their Disston saws, files and other tools.

That students take greater interest in their work, and progress faster, when tools are sharp and true, is a well-known fact. Most instructors also know that Disston steel and skill combine to provide the sturdiness needed for student use, plus the precision required for fine workmanship.

New tools are still scarce. So continue to care for your Disston tools, as you have been doing, and they should see you through. However, if your students are training for essential work, and you need additional tools, ask your local hardware retailer about Disston tools.

Each of your students should have a copy of the Disston Saw, Tool and File Manual. It will be supplied FREE by your hardware retailer.

Educational charts and other useful material, for your personal use, will be sent to you without charge. Write to us direct.

HENRY DISSTON & SONS, INC., 338 Tacony, Philadelphia 35, Pa., U. S. A.

TEACH PRECISION GRINDING FROM A TO Z ON A DUMORE!

Let them learn on the tool used throughout industry for both tool room and production work!

You'll simplify your own work and at the same time provide more realistic, practical training for your students if you teach them precision grinding on a Dumore. Two good reasons why: On a single Dumore Grinder, you can demonstrate and teach nearly every type of grinding, including cylindrical (internal and external), surface, and thread grinding to tolerances as close as a tenth. *And* you will be acquainting your students with the very same Dumore Grinder that on hundreds of difficult production jobs in thousands of war plants has proved its time-saving versatility, easy adaptability, and thorough dependability. One Dumore Grinder in your shop will quickly prove its value to you and your students. Write for catalog now! The Dumore Company, Tool Division, Dept. TC22, Racine, Wisconsin.

DUMORE
PRECISION AND HAND GRINDERS

Sold by Authorized Industrial Distributors in All Principal Cities

(Continued from page 60A)

d) Socket firmer, plain edge, ½ in., ¾ in., and 1 in.
e) Tanged firmer, bevel edge, ⅛, ¼, ½, ¾, 1, and 1¼ in.

CLAMPS
a) Bar, 24, 36, 48, and 60 in.
b) Hand-screw, 4, 5, 6, 7, 8, 10, 12, and 14 in.
c) Malleable-iron C, 4, 6, and 8 in.

DIVIDERS — wing, 6 in. and 10 in.
DOWEL PLATE — 6 in. long
DOWELING JIGS — with bushings
DRAWKNIVES — 7 in.
DRILL
a) Automatic hand, with 8 drill points
b) Chuck, 0 to ⅜ in.
c) Hand, 0 to ⅜ in., for round-shank drills
d) Star, for concrete, ½ in. and ¾ in.

FILES
a) Auger bit, assorted, 6 in.
b) Cabinet, 8 in. and 10 in.
c) Card and brush
d) Flat, wood, 10 in.
e) Mill, bastard cut, 12 in.
f) Round, bastard cut, 12 in.
g) Taper, slim, 5½ in. and 7 in.

FIRST-AID CABINET AND SUPPLIES
GAUGES
a) Bit, adjustable
b) Jointer
c) Marking, metal or hardwood
d) Mortise, metal or hardwood
e) Panel

GLASS CUTTER
GOUGES
a) Tanged firmer, outside ground, handled, ⅛, ¼, ½, ¾, and 1 in.
b) Tanged firmer, inside ground, handled, ⅛, ¼, ½, ¾, and 1 in.
c) Spoon, ½, ¾, and 1 in.

HAMMERS — claw, bell faced, 10, 12, 13, and 16-oz.
HATCHET — bench, 4-in. cut
JARS — earthenware, 1-qt. capacity
KNIVES
a) Jointer, to fit power machine
b) Planer, to fit power machine
c) Sloyd, 3-in. blade

LEVELS
a) Wood, 24 in.
b) Machinists', 12 in.

MALLETS — hickory, 3 by 5 in. head
NAIL SETS — 1/16 in. and 3/32 in. points
OILERS — bench, 1/3 pt., coppered, best grade
OILSTONES
a) 1 by 2 by 8 in. in iron box
b) Gouge slip, medium, 4½ by 2⅛ by ⅝ by 5/16 in.
c) Gouge slip, fine, 3 by 2 by ⅜ by ⅛ in.

PINCERS — 6 in. carpenters'
PINCH DOGS — ¾, 1, and 1½ in.
PLANES
a) Block, adjustable, 6 in. long, 1⅝-in. cutter
b) Circular
c) Combination, adjustable
d) Core box
e) Duplex, fillister and rabbet
f) Fore, ⅛ in., 2⅜-in. cutter
g) Irons, double
h) Jack, 14 in., 2-in. cutter
i) Jointer, 24 in.
k) Round, wood, 1¾ in.
l) Router
m) Smooth, 9 in., 1¾ in. or 2-in. cutter

PLIERS
a) Roundnose, 5 in.
b) Side-cutting, 6 in.

PUTTY KNIVES
RASPS — half round, wood, 10 in.
RULES
a) Board
b) 1 ft. or 2 ft. graduated by 8ths and 16ths
c) Shrink, ⅛ in., 3/16 in.

SAWS
a) Back, 12 in., 14 point
b) Band, to fit power machine
c) Compass, 10 in.
d) Coping, frames
e) Coping, blades
f) Crosscut, 9 tooth, 22 in. long
g) Crosscut, circular for power machine
h) Dado, ⅛ in. to 1 1/16 in. to fit power-saw arbor
i) Hack, frames, 10 in. or adjustable
k) Hack, blades, 10 in.
l) Keyhole, 10 in., 10 point
m) Rip, 7 point, 22 in. long
n) Rip, circular for power machine
o) Set, 10 points per inch and finer
p) Set, 10 points per inch and coarser
q) Turning frame, 14 in.
r) Turning blades, 3/16 by 12 in., 10 tooth
s) Miter box, 24 by 4 in. saw, 7-in. capacity at miter

SCRAPERS
a) Cabinet
b) Glue, triangular
c) Veneer, blade, 2¾ in. long, handle 11 in. long

SCREW DRIVERS
a) Cabinetmakers', 4, 6, and 8 in.
b) Quick return, spiral ratchet

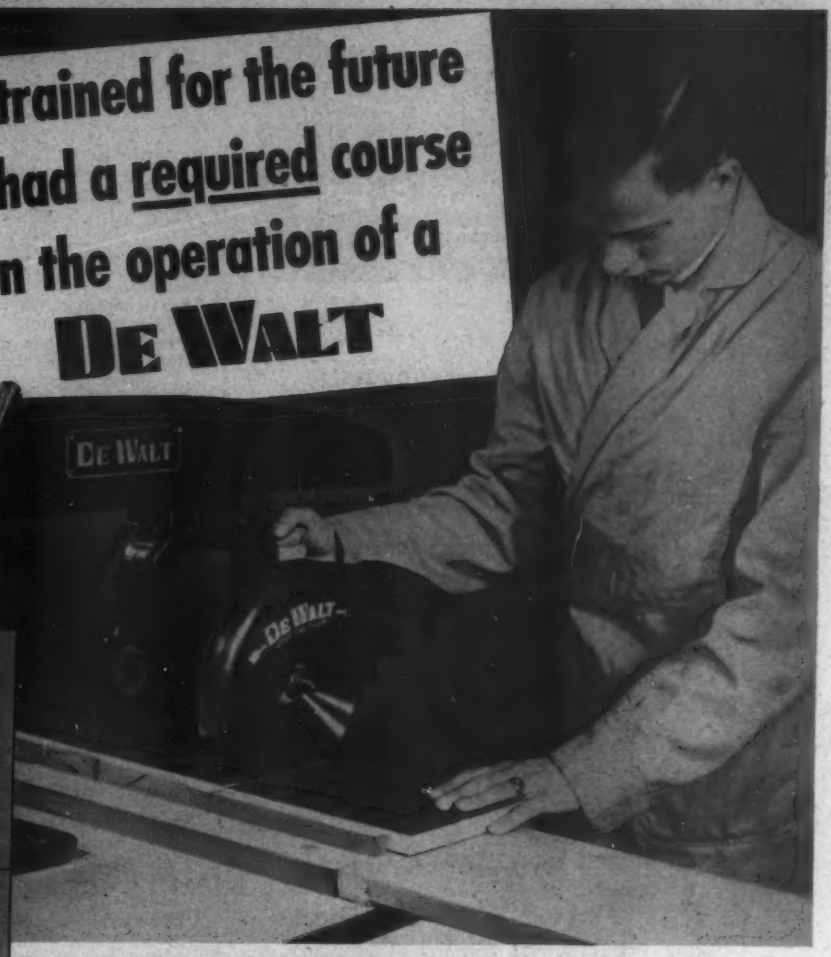
SHOOT BOARD — and plane
SNIPS — tinners', forged steel, 2½-in. cut
SPOKESHAVES — adjustable, raised handle, 10 in. long
SQUARES
a) Combination, 12 in.
b) Try-, iron handle, 8 in.
c) Framing, 2 ft.

STEEL FIGURES — hand cut, ⅛ in.
TAPELINE — 50 ft., steel
TRAMMEL POINTS — adjustable metal frame, steel points
TURNING TOOLS
a) Calipers, 6 in. inside and outside
b) Calipers, 12 in. inside and outside
c) Parting tools, ⅛ in.
d) Round point, ¼ in., ½ in., ¾ in.
e) Spear point, ¼ in., ½ in., ¾ in.
f) Square point, ¼ in., ½ in., ¾ in.
g) Turning chisels, ¼ in., ½ in., ¾ in.
h) Turning gouges, ¾ in., ½ in., ¾ in.
i) Turning skews, L.H., ¼ in., ½ in., ¾ in.
k) Turning skews, R.H., ¼ in., ½ in.

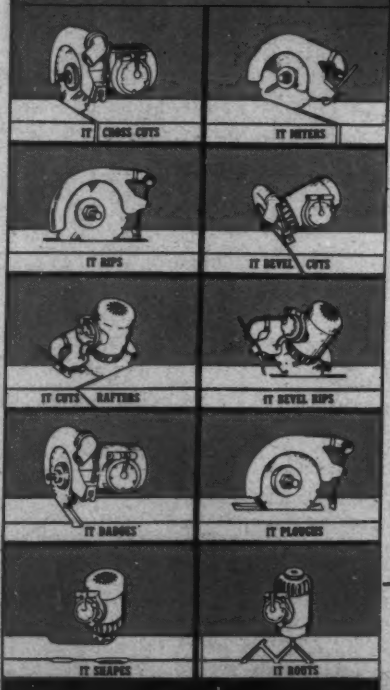
VISE — 3-in. jaw, anvil face
WRENCHES
a) Adjustable, 8, 10, and 12 in.
b) Headless setscrew
c) Pipe, 10 in. and 12 in.
d) S type or open-end type to fit ⅛-in. to 1-in. N.C. nuts

(Continued on page 64A)

He's really trained for the future when he's had a required course in the operation of a DE WALT



DE WALT is a complete shop in itself



...and with proper tools makes any cut possible!

After the student has completed his basic training course in the use of hand tools, he should have a *required* course in the operation of DeWalt.

Knowing how to make the fullest use of this flexible, easy-to-operate machine, will give any student a head-start as he prepares for tomorrow's industry.

When he leaves school he will be fully acquainted with a machine that is destined to occupy a prominent place in tomorrow's industry. The perfection of the DeWalt saw has created new methods in cutting wood, making obsolete old-style equipment previously used.

We urge you to investigate DeWalt. *Install* DeWalt in your school.

16 MM SOUND MOVIE— "DeWalt Saws in the War Program." The only sound movie on woodworking machinery now being used by the armed forces as part of their regular training courses. Available for supervisor meetings at no obligation. Write for details.

DeWALT PRODUCTS CORPORATION
123 Fountain Avenue, Lancaster, Penna.

☐ Please send me literature on DeWalt Saws.
☐ I would like more information about DeWalt Sound Movie.

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City_____ State_____

Detroit Public Library

Get Ready with Greenlee!
HAND TOOLS FOR THE CRAFTSMAN
CHISELS AND GOUGES
For all types of woodworking . . . GREENLEE chisels and gouges of crucible steel provide tough, lasting, fine cutting edges. Various types of socket, tang butt and firmer chisels, gouges and turning tools.
AUGER BITS AND DRILLS
There's a GREENLEE for every need . . . all types of twists and heads. Cutting parts precision-sized to indicated diameter, true-square shank tapers, filed-sharp edges.
EXPANSIVE BITS
For fast, uninterrupted cutting . . . newly-designed wide, open throat for positive chip clearance. Two styles: Set-fast Expansive Bit with quick adjusting-locking feature and Plain Expansive Bit.
SPIRAL SCREWDRIVERS
Built for years of hard service, the GREENLEE Spiral Screwdriver incorporates special, long-lasting, phosphor bronze drive nuts to withstand heaviest wear. Adjustments are quick, simple, positive. Available in small, medium and large sizes—with or without spring return.
AUTOMATIC PUSH DRILLS
Completely enclosed working parts keep out dirt and grit. Hardwood handle serves as magazine for 8 drill points supplied. Constructed with special phosphor bronze drive nut for long wear.
COMPLETE CATALOG No. 33
Your guide to all Hand Tools manufactured by GREENLEE for the woodworker. Keep on hand for quick reference. Be sure to get your FREE copy—write today!
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The GREENLEE Line also includes razor-blade draw knives, bit extensions and other high-quality tools for the woodworker.
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FOR THE CRAFTSMAN
GREENLEE TOOL CO.
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Woodworking—
Materials and Supplies

ALCOHOL

BENZINE

BRADS — 3/8 in., 1/2 in., and 5/8 in. No. 20; 3/4 in. and 7/8 in. No. 19; 1 in. No. 18; 1 1/4 in. and 1 1/2 in. No. 16; 1 3/4 in. No. 15; 2 in. and 2 1/2 in. No. 14

CARBON PAPER — black

COLORS — dry: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, Vandyke brown, and vermilion

COLORS — ground, in oil or japan: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, rose lake, Vandyke brown, and vermilion

DECALCOMANIA TRANSFERS

DOWEL PINS AND PLATES

DOWELS: hardwood, 3-ft. lengths, 1/4 in., 5/16 in., 3/8 in., 1/2 in., 3/4 in.

ENAMEL
- *a*) Selected colors
- *b*) Undercoater

FILLERS — paste: natural, golden oak, dark oak, and mahogany

FILLETS — leather, 1/4 in. and 1/2 in.

GLUE
- *a*) Casein, hide, best grade cabinet
- *b*) Liquid

HARDWARE: Brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports

HOOKS
- *a*) And eyes
- *b*) Cup
- *c*) Screw and
- *d*) Square screw

LACQUER — black, clear, cobalt blue, ivory, medium green, red, thinner, white, and yellow

LUMBER — Ash, balsa, bass, birch, cherry, cypress, locust, mahogany, maple, oak, poplar, red cedar, red gum, redwood, sap gum, yellow pine, walnut, white pine
In ordering pine, mill run, kiln dried will be found suitable for carpentry, while short, select, kiln dried, 4 in. and wider or No. 1 shop common, kiln dried will be required for cabinetmaking and patternmaking
Hardwood, for furniture, should be specified first and second grade, kiln dried, standard widths and lengths, or short lengths

MOLDINGS

NAILS
- *a*) Common, 6d, 8d, and 10d
- *b*) Flathead, 1/2 in. No. 20, 3/4 in. No. 19, 1 in. No. 18, 1 1/4 in. and 1 1/2 in. No. 16, and 2 in. No. 14
- *c*) Finishing, 4d, 6d, and 8d

OIL
- *a*) Linseed, boiled
- *b*) Linseed, raw
- *c*) Machine
- *d*) Rubbing

OVERLAY CARVINGS

PANEL OR PLYWOOD — 3 ply, 5 ply, and 7 ply

PATTERN LETTERS

PINS — escutcheon

PUMICE STONE — No. 0

RAPPING PLATES

ROTTENSTONE

SANDPAPER — Garnet cabinet paper, 3/0, 2/0, 0, 1/2, 1
Garnet finishing paper, 6/0, 4/0
Garnet paper can also be obtained in rolls of 50 yd. in widths 4 in. up to 48 in. Narrower widths on special order

SCREW EYES

SCREWS
- *a*) Flathead, brass, No. 3 by 3/8 in., No. 4 by 1/2 in., No. 5 by 5/8 in., No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/4 in., No. 12 by 1 3/4 in., No. 10 by 2 in.
- *b*) Flathead, bright, No. 3 by 1/2 in., No. 4 by 1/2 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 in., No. 8 by 1 1/4 in., No. 10 by 1 1/4 in., No. 14 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/2 in., No. 10 by 1 3/4 in., No. 12 by 1 3/4 in., No. 10 by 2 in., No. 12 by 2 in., No. 14 by 2 in., No. 12 by 2 1/4 in., No. 14 by 2 1/4 in., No. 14 by 2 1/2 in.
- *c*) Oval head, brass, No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., and No. 10 by 1 1/4 in.
- *d*) Roundhead, blued, No. 3 by 3/8 in., No. 3 by 1/2 in., No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/2 in.
- *e*) Roundhead, brass, No. 3 by 3/8 in., No. 4 by 1/2 in., No. 4 by 5/8 in., No. 5 by 3/4 in.

SHELLAC
- *a*) Orange, cut 4 lb. to the gal.
- *b*) Sticks, assorted colors
- *c*) White, cut 4 lb. to the gal.

NOTE: Shellac should be kept in glass or earthenware containers

STAINS — oil, spirit or water. Fumed oak, dark oak, golden oak, light oak, mahogany, and walnut

STEEL WOOL — No. 0 and No. 2/0

TURPENTINE

TWINE

VARNISH — coach, flat, remover, spar, and rubbing

WASTE — cotton, white

WAX — bees and finishing

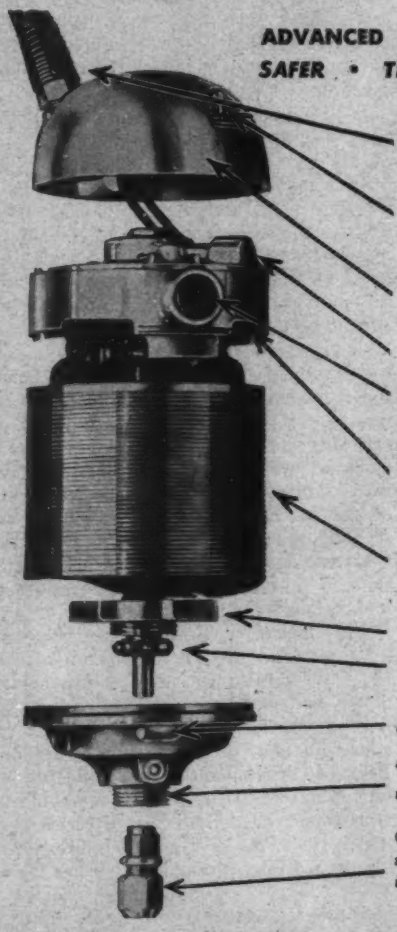
WHITE LEAD

TEACH PRESENT-DAY SHOP PRACTICE WITH THE IMPROVED--LOWER-PRICED STANLEY-CARTER RS4 ROUTER

With this one "all 'round" tool, you can teach hundreds of operations used every day in plants working wood, plastics, and light metals. The RS4A is just what you need to add new interest to your courses. With one simple attachment it becomes a Shaper; with another, a Carver.

Now better than ever, and lower-priced, the RS4A is a logical investment in shop equipment for any progressive school.

ADVANCED FEATURES THAT MAKE THE RS4A *SAFER • TROUBLE-FREE • LONGER-LASTING*



Spring protector over cord prevents sharp bends. *Gives longer life.*

Recessed switch to prevent turning switch on when motor is laid down. *Safety feature.*

Separate housing for switch connections. Eliminates collection of dirt in this section. *Means longer life for switch.*

Oiler for top bearing.

Brush caps protected by cast rim. *Eliminates breakage of brush caps.*

Air is taken in below brushes and all connections so that no dirt or air can circulate through these parts. *Gives longer life.*

Router casing is threaded to permit accurate adjustment for depth of cut. Eliminates measuring of bit extension. *Safety feature.*

Fan. *Keeps motor cool.*

Lower ball bearing.

Note large opening for air outlet permitting constant flow of air. *Gives longer life to motor.*

Threaded endshield for templet guides. *Makes templet true with bits.*

Chuck can be removed and replaced with arbor for shaping operations. *Two machines in one.*

MICROMETER THREADED DEPTH ADJUSTMENT

. . . for extra SAFETY

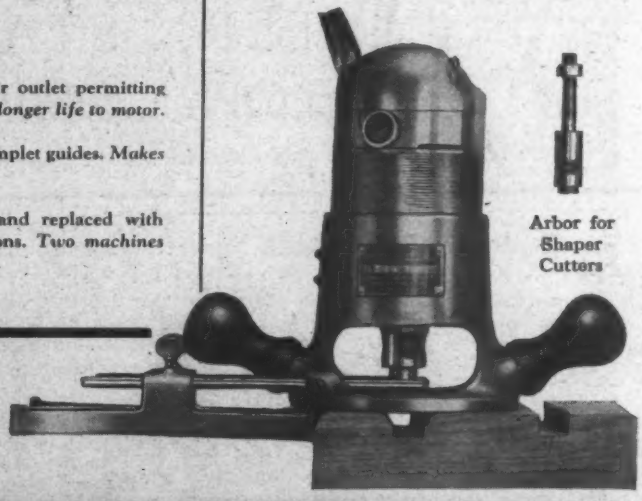
No handling of the bit or measuring with a rule is necessary. Adjustment is made by turning the motor unit in the base.

. . . for Dependable ACCURACY

Because accurate setting for depth of cut is easy, less work is spoiled. One complete turn raises or lowers the cutter 1/16", since there are 16 threads to the inch. One quarter turn adjusts the bit 1/64".

. . . for FASTER Setting

Changes in settings for cuts of various depths can be made much more quickly—and the time saved can be used for additional work with the RS4A.



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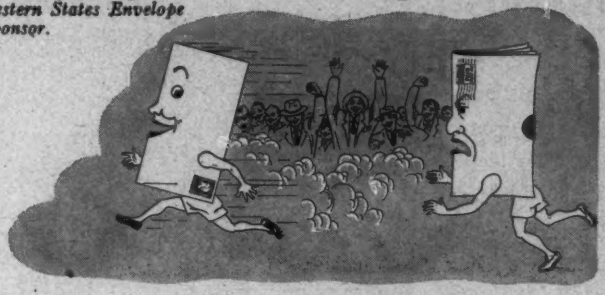
IDEAS from the files of the Direct Mail Research Institute, an organization of which Western States Envelope Company is a sponsor.



ENVELOPE-CLAD MAILERS WIN
where
NUDE FOLDERS FAIL

Which comes in first in the race for response, the envelope-enclosed offer or the non-enclosed offer?

Case histories, answering the question above in terms of RESULTS, show the ENCLOSED message packs more conviction than the non-enclosed.

For example, case history A-104 is that of a publishing company attempting to get renewal subscriptions by mail. Notices went out in two forms — one non-enclosed mailing piece to half the list, the other, enclosed in an envelope to the rest. *The enveloped notices brought back four times as many renewal orders as the non-enclosed notices!*

In another test leads for salesmen were sought by a bakery supply house. *An envelope-enclosed broadside won by 33⅓ per cent more response over the same broadside sent out as a self-mailer.*

Yes, an envelope surrounds your message with an importance that reaches out for attention — then gets done what you want done.

Write us for FREE folder, "FACTS about FORMS OF MAILING." It will reach you promptly.

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A WARTIME METALCRAFT CLUB

E. LE ROY LONGLEY

Baltimore Polytechnic Institute
Baltimore, Md.

The present conditions require that all metals be carefully salvaged for the needs of our fighting forces. This means that restrictions must be placed on the materials used by a metalcraft club. But be that as it may, youth must not be made to suffer entirely and have to give up the work which means so much to them in the rounding out of a good cultural education, for today's boys will be the homemakers of tomorrow and one of the great helps in the making of a home is to be able to design and make useful and ornamental projects for that home.

When the war struck, the author's metalcraft club was just about getting into full swing. During the three years of its existence a good program had been developed. The boys had been trained to be junior instructors in the various operations, and the club's officers were well advanced in their work, having spent the preceding years in training in the previous stages of the work. They were also at the place for securing the top rewards that are offered by the school for outstanding service in various fields of work within the school. The boys did not want to lose these awards any more than they wanted to stop the work which they enjoyed so much.

Then when the school opened in fall, the officers held their meeting with their adviser (the author in this case), and discussed the situation. The ways and means committee chairman was dispatched to the usual purchasing places of materials and told to report at a future time. His report was that copper, brass, and nickel silver, the club's main raw materials, were "out" except for the highest priorities which the club or even school did not have, and silver, the material for their jewelry work, was close on its way. Stones for settings were fast disappearing from the market, particularly the reasonably priced market. It also was reported that materials such as saw blades, steel wool, and others were either very difficult to get or extremely high in price. Tools, which the club tried to get the boys to purchase for their home shops, were found to be high and scarce.

The boys were discouraged. What could be done? Well, the answer, which was then partly in doubt, has come to be the real solution.

It so happened that just about that time the big scrap metal salvage drive was going on all over the country and the boys had been clearing their homes and shops of metal projects and materials of all kinds. They had also been helping to collect such materials from various places and got a good idea of things that were being disposed of. Why couldn't some of these items be salvaged, repaired, remade, combined, added to, subtracted from, and in some way produce an article of use and beauty for the home? The only argument to this was that it would take material that was critically needed by the government for essential war production. This, however, was balanced by the facts, first, that little of the material would be consumed and, second, that the government had asked that articles be repaired and used rather than to purchase other items. And so the idea was adopted.

This has been continued semester after semester, and to date the membership of the club is filled to capacity (twenty-five being the capacity), and there is a waiting list of others who desire entrance. Of course, a club of this nature is seasonal. Prior to Christmas, the club builds up, and its membership is at its maximum at Christmas. Then there is a decrease, after which there is a gradual buildup to a steady working group until spring arrives. With the greater inducement exerted by the great outdoors, enrollment and attendance will gradually drop until the closing of school for the summer. The club has been successful so far.

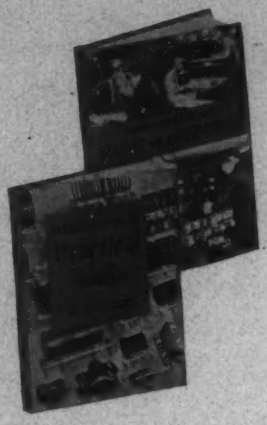
During the past semester a great number of ideas were developed and many were worked up. The fascinating, as well as helpful, part of the whole thing was that nearly every job was different and required creative thinking and planning.

Among those jobs that have been produced, and many may be visualized just by mentioning, are napkin rings that may be made from brass drain pipes from old plumbing or lighting fixtures. Candle sticks and lamps are easily and effectively produced from old chandelier parts. Small candle and taper holders may be made out

(Continued on page 68A)

NEW TEXTS AND MANUALS FOR TODAY'S COURSES... *in*

INDUSTRIAL ARTS



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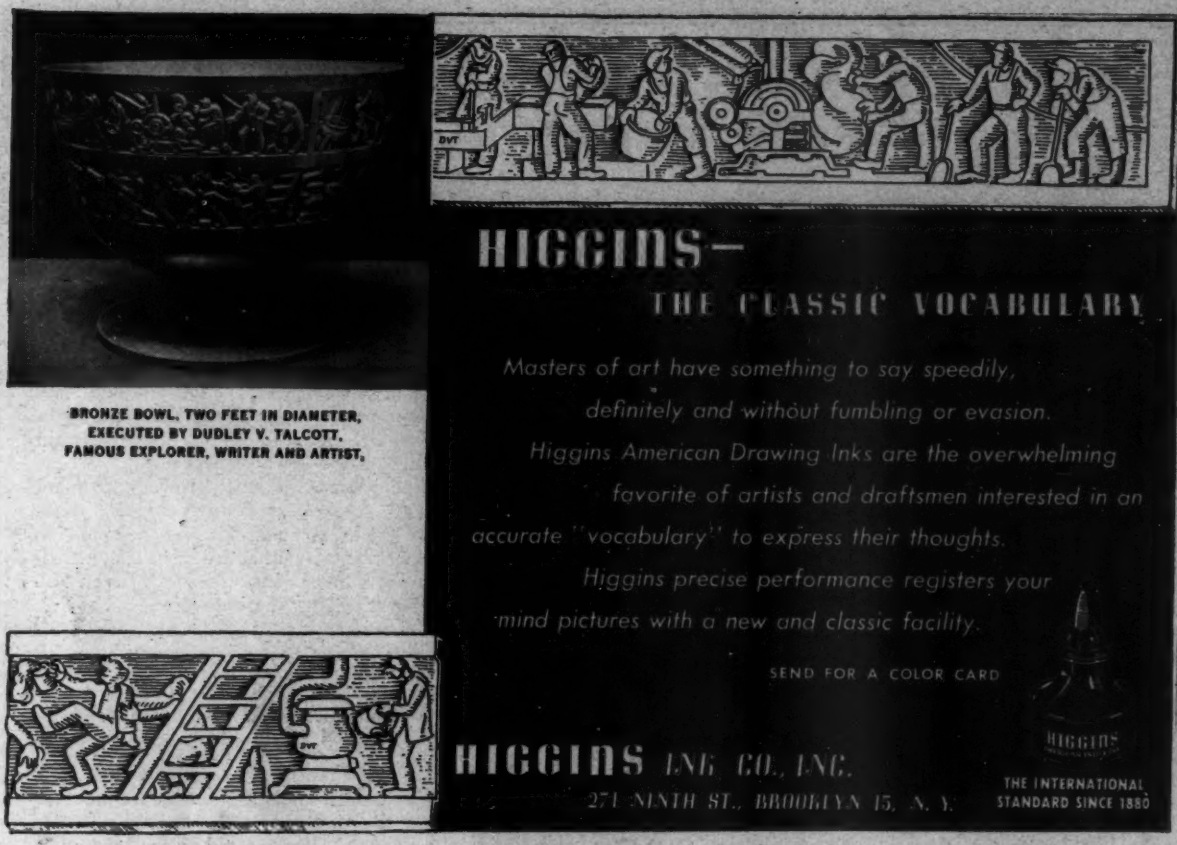
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BRONZE BOWL, TWO FEET IN DIAMETER, EXECUTED BY DUDLEY V. TALCOTT, FAMOUS EXPLORER, WRITER AND ARTIST.

(Continued from page 66A)

of various sizes of rifle shells. Sections from aluminum sprue pins from the foundry can easily be turned into rings, as can nuts of certain materials. Odd shaped pieces of metal may be prepared and used as paper weights. Small pieces of tubing may be made into dinner chimes.

Fig. 1. Duck pin bud vase

Cow horns may be made into various items such as legs for objects, ash receivers, and when cut in various ways may make likenesses of birds, fish, and the like. Sections of horns may be made into napkin rings, or neckerchief slides. Toothbrush handles and other odd pieces of plastic such as umbrella handles may be made into jewelry or into parts to combine with wood or metal to form some other project. Of course, the latter were deviating somewhat from wholly metal projects, but yet we use such materials and with the combination gained richness in the completed job.

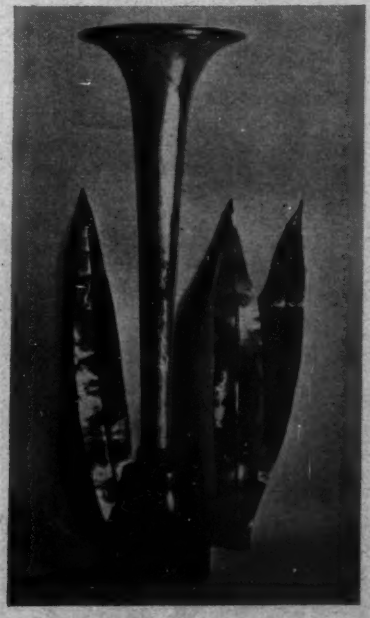

Fig. 2. Flower vase from old bugle

And so we go on and on with different items, but now let's get a few in detail. These I think are unusual.

To begin with, take a most common one — the duck pin. Many things have been made from old duck pins. Figure 1 shows how such a pin has been turned into a vase. This vase was finished in the lathe. Then a hole is bored into it, a test tube inserted, and the result is an attractive bud vase.

Figure 2 shows how a flower vase was made out of an old bugle.

Such old musical instruments are found in many homes, and most of them are scrapped after they become battered up. To turn one into a flower vase, straighten out the bell and remove any other dents, and then polish it. Perhaps a stippled or etched design would go well, or have it plain. Leaves of copper, as shown in Figure 2, may be added if desired. A turned wooden base, weighted and felted, is then added, and we have another interesting vase, which may carry the sentiment of that "old scout bugle" long into the future.

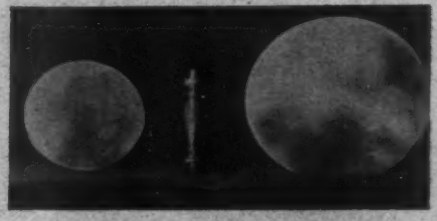

Fig. 3. Materials for making the goblet

(Continued on page 70A)

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Woodworking Machines

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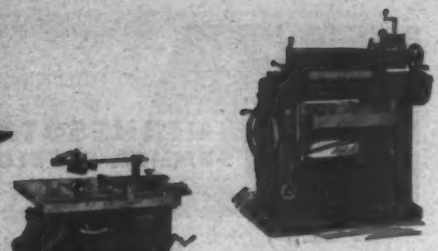
These important features responsible for "Oliver" Leadership are prominent factors in the progress and development of the woodworking departments in school shops — a development with which "Oliver" has been closely identified from the very beginning of Industrial Arts and Vocational Education. Years of satisfactory service in the woodworking industry preceding school shop acceptance and use has given "Oliver" a background of experience in providing the school shop requirements. The illustrations on this page are typical of the complete line of woodworking machinery now available for school shops.

Special attention is given to School Shop Executives and inquiries and correspondence relative to requirements are solicited.



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Double Arbor, Motor Arbor, Tilting Saw Bench

30-inch Band Saw

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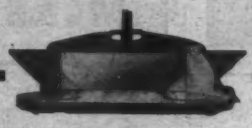

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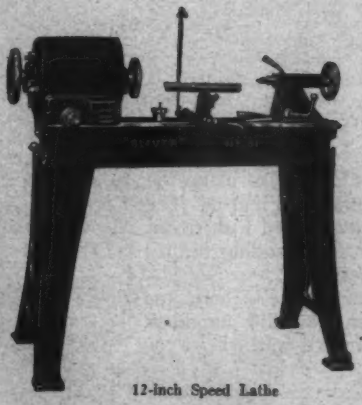

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McKNIGHT & McKNIGHT

(Continued from page 68A)

Figure 3 shows a project that was inspired by a small piece of turned brass, which was originally a brass post on a rail around the ends and back of an old sideboard. Removed for simplicity, these pieces became as excess material and would have been cast out, but for the fact that a *junk box* was in this particular home. It was from this box that a number of other similar pieces were also exhumed.

Fig. 4. A goblet completed

Fig. 5. Ash tray from horn

One of these posts was added to the two disks shown in Figure 3 to make the beautiful goblet pictured in Figure 4. The inside of this goblet was plated with silver, thus giving a contrast and adding beauty as well as greater usefulness.

Figure 5 shows how a piece of horn was converted into an ash tray and matchbox holder by adding metal worked up as shown.

If one recalls the carved wooden letter baskets from the early years of this century, he will recognize the base used for the next project. Figure 6 shows it with a hammered copper bowl superimposed upon it to make a serviceable flower holder. Incidentally, a glass bowl purchased from the dime store would make a less difficult and inexpensive project.

Figure 7 shows how a cruet holder, formerly used on the table or sideboard, was similarly transformed into an ivy bowl. Since the silver plating on the old cruet holder was gone, several coats of white paint were applied. Then with the addition of either a hammered copper ball as in the latter project, or a glass one purchased from the five and dime store, it becomes a holder for either cut flowers or an ivy vine.

Fig. 6. A flower bowl

Figures 8 and 9 show how the rim and glass taken from an old steam boiler gauge were transformed into a useful tray. The rim polished up beautifully. A piece of the threaded edge of the gauge housing was cut off and used for holding the glass in place. The assembly, as shown in Figure

(Continued on page 72A)

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for Progressive and Practical

SHOP SCHOOL TRAINING

The efficiency and broad adaptability of PORTER-CABLE tools have established them as "essentials" in many industrial plants throughout the country. These tools are easy to use and one quickly acquires unerring accuracy in operation . . . precepts of PORTER-CABLE tool engineering. PORTER-CABLE machine tools and hand power-tools offer DEFINITE ADVANTAGES IN SHOP SCHOOL INSTRUCTION because: First — they are standards of industry . . . the tools with which mechanics should be trained. Second — they improve the quality of student workmanship, always sustaining interest as fine tools. Third — they are SAFE TOOLS and require the minimum of operational supervision.

*Speed*matic SAWS

These correctly balanced saws cut fast, clean and accurately with minimum effort. Smooth helical gearing delivers 11% more power to the blade. The extra wide shoe guides the saw SECURELY and SAFELY, even when tilted at 45 deg. The balanced design facilitates one-hand operation in any position and the guard insures SAFETY. Anyone being trained for the building trade should be thoroughly instructed in the many uses of this saw.

G-8 Wet-Dry Belt Surfacer

A student proficiently trained on this machine becomes a valuable asset to industry. Pieces to be machined on the G-8 are either applied free-hand or held with simple holding fixtures. Parallelism, squared and flat surfaces can be held within a .0005 tolerance. Exceedingly efficient in free-hand chamfering, rounding and breaking corners, and polishing. Used extensively in industry on hard and soft metals, wood, fibre, plastics, ceramics and glass.

B-16 Wet-Dry Belt Surfacer

Designed for finishing irregular and curved surfaces. A flexible abrasive belt, wet or dry, follows the contours and produces an even, uniform finish. Equipped with an adjustable backing plate for flat or uniformly curved surfaces. Easy to use and saves hours of bench filing and grinding.

G-4 Belt Surfacer

This tool is ideal for free-hand grinding operations; first operations for location; surface finishing, and fast finishing operations on small parts. Rest table adjustable up to 45 deg. for accurate angle cutting. Choose a PORTER-CABLE belt surfacer for teaching versatility and production possibilities.

TAKE-ABOUT The Dustless Sander

True surfacing can be most easily taught with this balanced sander. It is equipped with a powerful cool-running motor, housed from dust; silent chain drive; and ball-bearing construction throughout. Instant "quick flip" belt change and easily detachable dust bag. Results are gratifying from first usage . . . it relieves many tedious hand-sanding jobs.

*Speed*matic FLOOR SANDER

Here is the fastest, cleanest, smoothest-cutting floor finisher made. Its high-speed balanced drum has a sensitive feel-of-the-floor adjustment, immediately apparent to the operator. High-Vacuum dust collection adds to the operator's comfort. Whether used for instruction in floor sanding, or for conditioning school floors, you will learn that the PORTER-CABLE *Speed*matic Floor Sander out-performs all others.

PORTER-CABLE Machine Co.
1702-1 N. Salina Street, Syracuse 8, N. Y.

Please send me without obligation descriptive matter on Porter-Cable machines indicated below.

☐ Wet-Dry Belt Surfacers ☐ Speedmatic Floor Sanders
☐ Take-About Sander ☐ Speedmatic Saws

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Individual ..... Position .....

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WEATHERVANE SILHOUETTES

By FRANK E. HARDIN

A series of 24 attractive, original, full-size weathervane patterns — just off the press!

Designed by one of your own — and one of America's best — artist-craftsmen, Frank Hardin, Manual Training High School, Peoria, Ill. Arranged in two styles — the simpler, 25-inch type, and 50-inch masterpieces such as the Prairie-Schooner display here illustrated. "Weathervane Silhouette Manual," describing and illustrating *each pattern* in reduced size, and all processes and materials, supplied *for only the cost of handling and mailing* — 10 cents.

THE PATTERNS: #1 — Crowing Cock. #2 — Fixed Pointer. #3 — Farm Tractor. #4 — Sloop. #5 — Yacht. #6 — Clipper Ship. #7 — Spreading Eagle. #8 — Witch Riding Broom. #9 — Parrot and Arrow. #10 — Racing Sulky. #11 — Bronco Buster. #12 — Polo Clash. #13 — Cat Fight. #14 — Cock Fight. #15 — Cat and Dog Fight. #16 — Greyhound Race. #17 — Geese Scolding Puppy. #18 — Buffalo Hunt. #19 — Steeplechase Fall. #20 — Sweepstakes Finish. #21 — Fox Kill. #22 — Carriage and Escort. #23 — Prairie Schooner. #24 — Stagecoach Express.

Small sizes — #1-12 and 14, 15: 35c each, incl. "Manual."
Large sizes — #13 and 16-24, 50c each, incl. "Manual."

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Director of Summer Sessions

Room 105 Burrowes Building

THE PENNSYLVANIA STATE COLLEGE

State College, Pennsylvania

(Continued from page 70A)

9, shows first the glass, then a piece of tin plate that had been coated with Egyptian Jack Frost lacquer to give it a frosted finish, then a padding of cardboard,

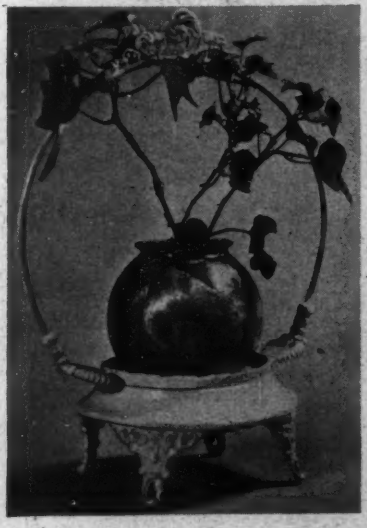


Fig. 7. Cruet holder into ivy bowl

all of which is held in place by the threaded piece cut from the rim of the gauge. Glue a piece of felt over the bottom to prevent scratching the finish of the object on which the tray may be placed.

Fig. 8. Tray from rim of old steam gauge

Many other projects could be listed. Many are now in work and may give interesting ideas later. But for the present let this conclude the list. It is concluded with the hope that these projects show the many possibilities that are to be had at home or in the school, in recreating new and useful projects from old ones, thus stimulating the thinking, developing the much needed creativeness, and keeping alive the extracurricular shop work programs of clubs in these critical times.

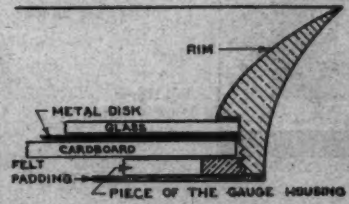


Fig. 9. Sectional view of tray made from a steam gauge

PROVIDING FOR INDIVIDUAL DIFFERENCES IN SHOPWORK

CHARLES H. SECHREST
Dearborn, Mich.

Providing for individual differences in pupils of industrial arts is one of the major problems of the industrial-arts teacher. The shop teacher must make his course of study meet the needs of the majority of his pupils. He cannot build it to fill the needs of the faster workers nor can he retard the progress of the class to keep his course of study abreast of the slower workers. A majority of the class may attain the goal set by the teacher, but a small percentage of the pupils will not reach it. Still another group of pupils will reach the goal and need more work to carry on or go beyond the limits set by the teacher. Many discipline problems arise because this latter group of faster workers do not have a job to do.

To take care of these students, set aside certain jobs or projects as *extra* jobs or *selected* jobs. A job sheet should be written by the teacher for each one of these selected jobs. These job sheets should be as clear and definite as possible. The more explicit they are the greater the chances are that the pupils will understand them, and therefore, will succeed in following them. Job sheets should not be too long nor too involved.

It is possible to have the selected jobs grouped according to the different grade levels. For example, permit a seventh grade pupil to go to the display case or display panel and chose a job that a

(Continued on page 74A)

ATKINS

Teach Him With Tools He's Likely To Be Using Himself!

When your pupils leave the classroom and embark upon their chosen trade, chances are good that Atkins Silver Steel Saws will be the tools they choose. Teaching them with Atkins Saws *now* means faster learning and better work. These fine saws have a "feel" that is natural and keen teeth that hold their edges for long periods. What's more, their ruggedness is an extra asset in the class room, where green hands are likely to give saws a real work-out.

Free—Wall Chart on Saw Filing

Illustrates in detail the right way of filing and setting saw teeth. 19" x 25", it's suitable for wall mounting. Sent to you free on request.

E. C. ATKINS AND COMPANY
404 South Illinois Street, Indianapolis 9, Indiana

Silver Steel SAWS

Agents or Dealers in All Principal Cities the World Over

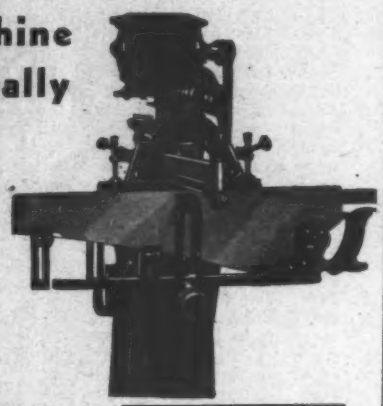
DOUBLE

the Cutting Life of Your Saws!

Nothing is more important to the success of your training program than your saws. Students dull them fast — they need sharpening often.

With a Foley Automatic Saw Filer you can sharpen your saws more perfectly than is possible by hand. Yon can do it quicker,—and your saws will stay sharp longer. Your students will turn out better work with sharp saws. ALSO by keeping your saws sharp with a Foley,—you will easily double their cutting life and have less breakage, reducing replacements to a minimum.

ONE Machine Automatically FILES Hand... Band... CIRCULAR SAWS



The Foley is the only machine that files and joints all hand, back and mitre box saws from 3 to 16 points per inch, cross-cuts circular saws up to 16" diameter (24" optional), and band saws up to 24' long. Patented jointing principle automatically evens up large and small teeth, so saws cut faster, truer, cleaner — stay sharp longer.

Train your students to file saws on a Foley, for they will find thousands of Foley Saw Filers used in industry, Army, Navy, Air Corps, etc. Hundreds of schools and colleges use them to save on saw filing costs and replacement expense.

TYPICAL SCHOOL USERS

Berea College, Berea, Ky.; Board of Education, Cleveland, Ohio; Boys Technical H. S., Milwaukee, Wis.; Q.M. Army War College, Washington; Stout Institute, Menomonie, Wis.

30-DAY TRIAL OFFER

You may have the privilege of using a Foley Saw Filer in your own shop for 30 days,—and see for yourself its training advantages and operating economies. Send coupon for details.

FOLEY AUTOMATIC SAW FILER

FOLEY MFG. CO., 18 Second St. N. E., Minneapolis 13, Minn.
Please send me full information on Foley Saw Filer and 30-DAY TRIAL OFFER.

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Osborn Public Library

Print-Shop Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BELLOWS
- a) Hand, small size
- b) Electric, blower type

BLACKBOARD — permanent or portable

BOOKCASE — for reference books, catalogs, etc., sectional preferable

BRAYER — 6 or 8 in. for proofing

BRUSHES
- a) Bench
- b) Benzine, No. 1, oval black
- c) Floor
- d) Padding, 1½ in. wide

BULLETIN BOARD

CABINETS
- a) Galley, for double column, wood or steel, four tiers (to be used with typesetting machines)
- b) Galley, for 8¾ in. by 13 in. galleys, wood or steel, four tiers
- c) Ink and roller, to accommodate platen-press rollers, wood or steel
- d) Matrix, for use with typesetting machines only
- e) Roller, cabinet or rack for cylinder rollers
- f) Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine
- g) Type, school type, each to accommodate two California cases, job cases, case slides, galley slide, and copyholder
- h) Type, complete with 24 full-size California job cases, with overhead lead-and-slug cases, wood
- i) Type, complete with 24 full-size California job cases, double work band, wood or steel
- k) Wood or metal, for filing class records, instruction sheets, etc.
- l) Storage for cuts

CANS
- a) Benzine, pint size
- b) Benzine, 5-gal. size
- c) Kerosene, safety, 1-gal. size
- d) Waste can, fireproof, for rags

CASES
- a) Blank, full-size, to accommodate ¼-size cases
- b) Border, ¼ size, for ornamental borders
- c) Lead and slug, regular size, to hold laborsaving fonts of leads and slugs
- d) Metal furniture, to hold laborsaving fonts
- e) Rule, ¼ size, for brass rule

CHAIRS — teacher's and tablet arm

CHASE RACKS
- a) For platen presses
- b) For cylinder presses

CHASES
- a) For each size of platen press
- b) For cylinder press

COMPOSING STICKS — 6 by 2 in., 8 by 2 in., 12 by 2 in., and 18 by 2 in., adjustable

CUTTER
- a) Lead and rule
- b) Paper, lever type, 20 in., with pedestal. Should handle 20 by 26-in. sheet
- c) Paper, lever type, 26 in. or 30 in.
- d) Paper, lever type, 30 in., with divided back gauge
- e) 30 in. to 36 in. power cutter

DESK
- a) Bindery, 80 by 36 in.
- b) Drying rack
- c) Imposing, 51 by 39
- d) Make-ready, 32 by 24 in.
- e) Paper cutters, 80 by 36 in.
- f) Proofreaders
- g) Teachers

DRYING RACKS
- a) Combination drying rack and stock table for platen presses, 30 trays
- b) Trays, interlocking, for cylinder press

FOLDING BONES — for hand folding

FOLDING MACHINE — 20 by 26-in. size, 4 fold, two parallel and two right-angle folds, power

FURNITURE — iron, 2 by 4 to 10 by 15 picas

GALLEYS — Steel, 8¾ by 13 in., 6¼ by 23½ in., double column, and 12 by 18 in.

GAUGE PINS — spring tongue

GLUE POT — electric, 1-qt. size

IMPOSING TABLES
- a) 12 by 18 in., with iron top, including reglets and furniture
- b) 24 by 36 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- c) 36 by 48 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- d) 39 by 63 in., with iron top, complete drawers, letter boards, reglets, and furniture

INK FOUNTAINS
- a) Short, for 8 by 12, 10 by 15, and 12 by 18 presses
- b) Long, for 10 by 15, and 12 by 18 presses

KNIVES
- a) Overlay, for make ready
- b) Ink, 6 in. and 8 in.
- c) Ink, 8 in., square end

LEADER BOXES

LEADERS
- a) 6, 8, and 10 pt., fine dot
- b) 8 and 10 pt., hyphen

LINE GAUGES
- a) Metal, brass, or steel
- b) Wood

MALLET

METAL FURNACE — for recasting and refining type metal, used only with typesetting machines

MITERING MACHINE

NUMBERING MACHINES
- a) For use on presses
- b) Hand machines

ORNAMENTS
- a) Assorted floral and decorative designs
- b) Border, 6 and 12 pt., decorative

PAPER-DRILLING MACHINE

PERFORATOR
- a) 24 in., foot treadle
- b) 28 in., foot treadle

PLANER
- a) Mallets, hickory or fiber
- b) Proof, maple, with felt bottom
- c) Type, maple, with leather top

PRESSES
- a) Cylinder, two revolution, four roller, 17 by 22, complete with variable-speed motor, cast rollers, etc.
- b) Platen, 8 by 12, with foot treadle, counter, flywheel guard, platen guard, brake, and set of cast rollers (motor and treadle combination if desired)
- c) Platen, 10 by 15, complete with variable-speed motor, counter, flywheel guard, brake, and set of cast rollers, etc.
- d) Platen, 12 by 18, complete with variable-speed motors, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc.
- e) Proof, 14 by 18, with cabinet
- f) Proof, 20 by 24, with cabinet
- g) Proof, 23 by 24½ with cabinet
- h) Tableting

PUNCH
- a) Foot power, multiple with assorted punches
- b) Lever, two die, with assorted punches
- c) Power, multiple, with assorted punches (paper drill may be substituted)

QUOINS
- a) Sizes No. 1 and No. 2
- b) Keys, Sizes No. 1 and No. 2

RULE — plain and brass (fonts to fit quarter cases)
- a) 2 pt., laborsaving, hair line, side face
- b) 2 pt., laborsaving, 1 pt. side face
- c) 1 pt., laborsaving, 1 pt. face
- d) 2 pt., laborsaving, double face

SAW TRIMMERS — pedestal type, with point gauge, and raising and lowering table

SILK-SCREEN UNIT

SPACING MATERIAL
- a) Iron furniture, as selected
- b) Leads, laborsaving, 2 pt.
- c) Leads, 2-ft. strips, 2 pt.
- d) Slugs, laborsaving, 6 pt.
- e) Slugs, 2-ft. strips, 6 pt.
- f) Spaces and quads
- g) Thin spaces, brass and copper, assorted sizes, 6 to 8 pt., one size in each box

SPECIMEN DISPLAY BOARD

STAPLE BINDER — pedestal type, foot power

STEREOTYPING UNIT, 8 by 12 in.

STITCHER — wire, power, capacity ½ in. or ¾ in., flat- and saddle-back tables

TWEEZERS — 3½ in.

TYMPAN PAPER (with combination holder and cutter)
- a) 18 in.
- b) 38 in., upright, to be used with cylinder press only

TYPE
- a) Body, lightface — 8 and 10 pt.
- b) Job, lightface — 6, 8, 10, 12, 14, 18, 24, 30, 36, and 48 pt.
- c) Job, lightface italics — 8, 10, 12, 14, 18, 24, and 36 pt.
- d) Job, boldface — 6 and 8 pt.; 12 pt., No. 26; 12 pt., No. 27; 12 pt., No. 28; 18 pt., No. 30
- e) Job, light copperplate Gothic — 6 pt., Nos. 1, 2, 3, 4; 12 pt., Nos. 5, 6, 7, 8
- f) Job, condensed title Gothic — 12, 18, 24, 36, 48, 60, and 72 pt.
- g) Job, text type — 10, 12, 14, 18, and 24 pt.
- h) Job, typewriter type — 12 pt. with spaces
- i) Job, boldface italic — 8, 10, 12, 14, 18, 24, 30, and 36 pt.
- k) Job, heavy copperplate Gothic

(Continued on page 76A)

(Continued from page 72A)

seventh grade pupil is capable of making. After the pupil has made his selection, the teacher should give him a mimeographed job sheet which is to be followed. Such a job sheet follows.

Cutting Board

One of the special jobs that you make in shop is a cutting board. You will find a model of it in the display case and a blueprint of it hanging in the woodwork department. Paste these directions in the sketch section of your notebook. Plan the job carefully. You will find the necessary dimensions on the blueprint and the "Steps in Doing the Job" in the directions which follow. List the tools and materials in your work plan. Get the teacher's O.K. before you start the job.

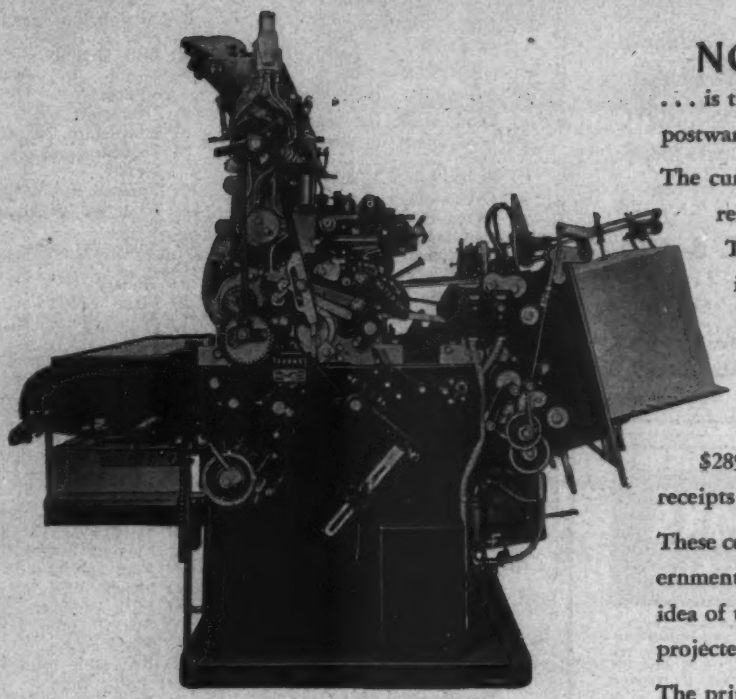
The first step in doing this job is to get out the stock. The cutting board is made of rough basswood that you may obtain from the stockman. The finished size of the cutting board is 1 by 6 by 10 in. The rough stock should be about 1 by 7 by 11 in. This will allow 1 in. on the width, and 1 in. on the length for planing and sawing.

The second step in doing the job is to square the rough stock to the proper dimensions, 1 by 6 by 10 in. To square rough stock, first plane the best surface until it is smooth and flat. Then plane the best edge until it is smooth and square with the finished surface. Use a try square to test the surface and to test the edge for squareness. The third operation to square rough stock is to saw off one end. Only saw off about ¼ in. For small and fine work use a backsaw. Then measure 10 in. from the finished end and saw off the other end. After both ends are square with the finished surface and finished edge, measure the width of the cutting board which is 6 in. Plane that edge square. The last operation to square rough stock is to plane the other surface smooth and flat.

Step three should be to get the teacher's O.K. so that he may see that you are progressing correctly. The fourth step is to lay out the corners and to locate the hole by which the cutting board is hung. Such

(Continued on page 84A)

Prepare now to meet the current trend to Offset in the Printing Industry



NOW... during this reconversion period ... is the right time to include OFFSET in your postwar printing plans.

The current trend in the printing industry truly reflects the keen interest offset has aroused. The Department of Commerce reports an increase in 1939 of 88% in products and receipts in Lithography and Photo Lithography over 1929, or $154,000,000 for 1939 compared to $129,000,000 in 1929. Estimated figures for 1946 are put at $289,000,000, or an increase in products and receipts of 129% over 1929!

These convincing figures, based on authentic Government sources, will give educational leaders an idea of the growing possibilities of offset in their projected vocational activities.

The printing industry needs young men and women trained in the offset process. It must secure many of these future operators from the vocational schools of America.

ATF offset presses, cameras and plate-making equipment are ideal for teaching the offset process. We invite inquiries from school executives interested in the possibilities of offset printing. No obligation, of course.

American Type Founders

Department of Education

200 Elmora Avenue, Elizabeth B, New Jersey

ATF

OF VITAL *Importance*

Lead and Rule Cutters and Mitering Machines are of vital importance. They should be checked frequently and repaired or replaced if there is a QUESTION of accuracy.

New ROUSE tools will often solve the problem of work-ups, bad corners, and springy forms. Completely equip your composing room with ROUSE tools, NOW.

See your nearest dealer, or write for circulars today.

H. B. ROUSE & CO.

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Practical Textbooks

Examine Them on APPROVAL

These modern texts have been especially prepared for school use. You can employ them to excellent advantage in your War Training and regular programs as well as your rehabilitation work. An examination will convince you of their suitability to your classroom needs. Any books sent for 30 days ON APPROVAL inspection subject to our educational discount if retained.

What Is Vocational Education? (George Fern)	$2.50
How You Can Get a Better Job	1.50
Fundamental Business Law	3.00
Slide Rule Simplified (with rule)	3.50
Slide Rule Simplified (without rule)	2.50
Fundamentals of Radio and Workbook (PIT)	2.50
Fundamentals of Electricity and Workbook (PIT)	2.50
Fundamentals of Machines and Workbook (PIT)	2.50
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AMERICAN TECHNICAL SOCIETY,
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Please send the following texts for 30 days ON APPROVAL examination. I will either return them at the end of that time to remit less your educational discount.

Name _____

School _____

School Address _____

(Continued from page 74A)

— 6 pt., Nos. 21, 22, 23, and 24; 12 pt., No. 25
l) Wood, condensed Gothic — 8, 12, 15, and 18 line
m) 10 pt. line leaders, 4 dots to the em
n) 10 pt. braces and dashes
o) 10 pt. fractions
p) 10 pt. references
q) Parentheses and brackets
r) 2 pt. laborsaving leads, 4 to 25 picas
s) 6 pt. laborsaving slugs, 4 to 25 picas
t) 2 pt. laborsaving brass rule
u) 2 pt. miters for rule
v) Laborsaving metal furniture
w) Thin spaces with quarter-size case

TYPESETTING MACHINES
a) Either linotype or intertype, 2 or 3 magazines, and molds
b) Matrices for same, 6, 8, 10, and 12 point, as selected

VISUAL AID CHARTS

Print-Shop Supplies

BENZINE OR GASOLINE — for cleaning type or presses

BINDERY TAPE — 2 in. wide, brown or black

GOLD BRONZE — pale

INK
a) Bond, black, for bond papers
b) Book, black, for school papers, etc.
c) Cover, colors as selected
d) Dryers and compounds, as selected
e) Half tone, black
f) Job, colors as selected
g) Metallic, gold and silver
h) Process, black, red, yellow, blue

KEROSINE — for cleaning rollers

PADDING CEMENT
a) Cold
b) Hot

PAPER
a) Bond, fine grade, 17 by 22 — 20, white
b) Bond, medium grade, 17 by 22 — 20, white
c) Bond, sulphite, 17 by 22 — 20, white
d) Bond, sulphite, 17 by 22 — 20, colors as selected
e) Book, enamel, 25 by 38 — 80, white
f) Book, machine finish, 25 by 38 — 80, white
g) Book, eggshell finish, 25 by 38 — 60, white
h) Cover, as selected, 20 by 26, medium
j) Card Bristol, fine grade, 22 by 28 — 4 ply, white
k) Index Bristol, medium grade, 25½ by 30½ — 110, white
l) Index Bristol, medium grade, 25½ by 30½ — 140, white
m) Mill Bristol, medium grade, 25½ by 30½ — 140, colors as selected
n) Pressboard, red
o) Strawboard, No. 40 or No. 50
p) Tagboard, manila, 24 by 36 — 140
q) Tympan, to fit presses
r) Wrapping paper, size as selected
s) Holder for same

PASTE
a) Bindery
b) Make ready

SILK-SCREEN SUPPLIES consisting of:
a) Silk-screen process paste paint, 1 each of the following colors: toluidine red, strontian yellow, ultramarine blue, medium green, rich brown, orange, purple, white, and black
b) Solvent profilm in 11- by 14-in. sheets
c) 8-in. synthetic squeegee
d) 11-in. synthetic squeegee
e) No-clog varnish
f) Film solvent
g) Stencil filler
h) Filler remover
j) Stencil knife
k) Fiber guides
l) Red sable brush — ½ in.
m) Putty knife
n) Frame tape

TWINE — cotton, for tying jobs

WIRE STITCHING
a) No. 28 round wire for stitcher
b) Wire staples, ¼ in.

Drafting Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

ADJUSTABLE-CURVE RULER

BEAM COMPASS

BENCH BRUSHES

BLACKBOARD
a) Permanent or portable
b) Compass, 15 in., with locking device
c) Drawing set: T square, straightedge, triangle, and protractor

BLUEPRINT
a) Frame or machine
b) Washing trays or washer
c) Paper tube, airtight
d) Drying rack or dryer

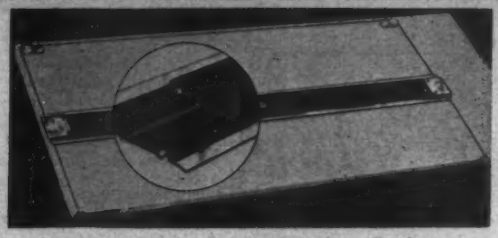
BOOKCASE

CABINET
a) For filing drawings

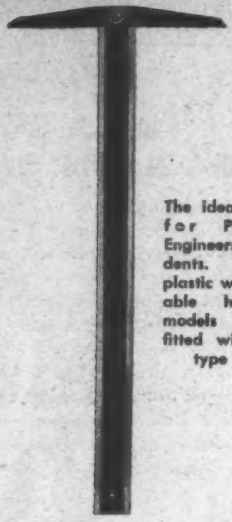
(Continued on page 78A)

PRECISION DRAFTING EQUIPMENT FOR TODAY'S STUDENT

ESCO Plastic Divider with interchangeable points and realignment feature. An instrument that feels at home in the hand.



Mobile Parallel Ruling Straightedge. The finest straightedge obtainable today. Equipped with retractile rollers which prevent smudging of drawing. Every school drafting room should have one of these.



The ideal T-square for Professional Engineers and students. Laminated plastic with removable head. All models can be fitted with Swivel type head.

Navigator's Case with ESCO Plastic Compass and Divider. Also contains Screw Driver and Vial with extra leads and points. A useful set for the student and seasoned navigator.

ESCO Products

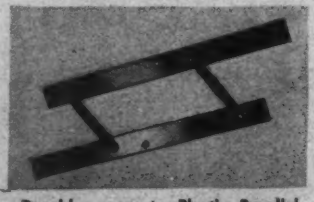
REG. U.S. PAT. OFF.

SYMBOL OF SUPERIORITY

ESCO provides the student with the finest Drafting and Navigating equipment obtainable.

ESCO qualifies by meeting the exacting requirements of War industries and the Armed Forces.

Student Drawing Kit consisting of Drawing Board Formica T-Square, and two transparent plastic Triangles.



Durable, accurate Plastic Parallel Rulers for navigation and other purposes. Used by the U. S. Navy.

A leatherette covered Carrying Case designed for our Professional Kit — with pocket for drawings and tracings. A very practical and usable piece of equipment.

A handy refillable type Pencil Pointer with Felt pad to clean pencil point. Ideal for the classroom.

Drafting Table: with the ESCO 5-ply top. Comes equipped with or without Parallel Ruling Straightedge — sizes 21" x 26" Top through 30" x 42" Also in five larger sizes. Table is adjustable to height.

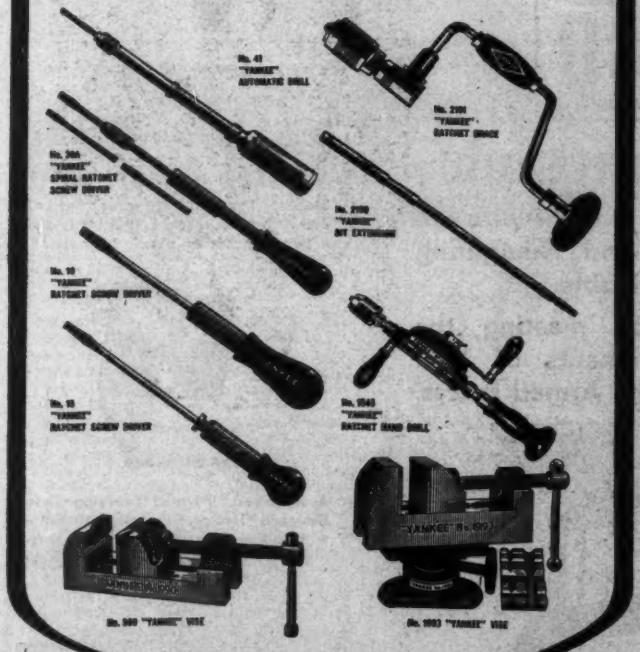
The ESCO Professional Drawing Kit. Five-ply board, parallel ruling Straightedge, elevating arms, and suction cup feet. Sizes 12" x 14" through 30" x 42".

ENGINEERING MANUFACTURING COMPANY

702 CLARA AVENUE, SHEBOYGAN, WISCONSIN — **11 S. LASALLE ST., RM. 1217, CHICAGO, ILL.**

WILL SOLVE THE PROBLEMS OF TOMORROW

It is the young men of today — the students of industrial arts — who must face the problems which will arise before tomorrow's engineering marvels become reality. And tomorrow, as today, the ingenuity and reliability of "Yankee" Fine Mechanics' Tools will make them fitting helpers for these future craftsmen in their challenging task. "Yankee" Tools are designed for teaching . . . for saving time in the classroom as they do in the workshops and on the assembly lines of the nation. Teach with the tools that experienced craftsmen have used for nearly half a century. Remember, though, that war has first call.



"YANKEE" TOOLS

make good mechanics better

North Bros. Mfg. Co., Phila. 33, U. S. A.

Established 1880

(Continued from page 76A)

b) For storing drawing boards
c) For storing drawing instruments
d) For storing models

CALIPERS — 6 in. and 8 in., inside and outside
CHAIR — teacher's
DESK — teacher's
DIVIDERS — proportional
DRAFTING MACHINE — and accessories
DRAFTSMAN'S STEEL PROTRACTOR
DRAWING BOARDS — large
DRAWING-BOARD SUPPORTS — to be set on or attached to woodworker's bench
DRAWING TABLES AND STOOLS
a) For students
b) For teachers
INK-BOTTLE HOLDER
IRREGULAR CURVES — Nos. 17, 21, and 24, wood, rubber, or transparent
LETTERING ANGLES
LETTERING PENS — assortment of 12
LEVEL OR TRANSIT — builders' for architectural students
LEVELING ROD — for use with the transit
MACHINISTS' COMBINATION SET — 12 in.
MARKING PINS — for use with measuring tape, for architectural students
MICROMETER — 1 in., for mechanical-drafting students
OILSTONE — 3-in. case
PANTOGRAPH — 21 in.
PARALLEL RULES
PLANIMETERS
PLUMB BOB
SHEARS — for trimming blueprints and drawings
SPEED COUNTER — for mechanical-drafting students
STEEL SCALES — 12 in.
STOP WATCH — for mechanical-drafting students
TABLE
a) For cutting and trimming drawings and blueprints
b) For disassembling and reassembling machine parts and models
TAPELINE
a) 100 ft., steel, for architectural students
b) 50 ft., steel or metallic
TOOLBOX — containing 1 machinists' hammer, one 6-in. adjustable wrench, one 6-in. screw driver, one 6-in. combination pliers
TRIANGLES
a) 30–60 deg., 14 in. transparent
b) 45 deg., 10 in. transparent
TRIANGULAR SCALES — civil engineers' type, 12 in.
T SQUARE — adjustable or fixed head, for large drawing board or straightedge with parallel rule attachment for large drawing boards
WALL CHARTS — lettering, decimal equivalents, etc.
YARDSTICK

To be provided by, or for, each student

Drafting—Small Equipment

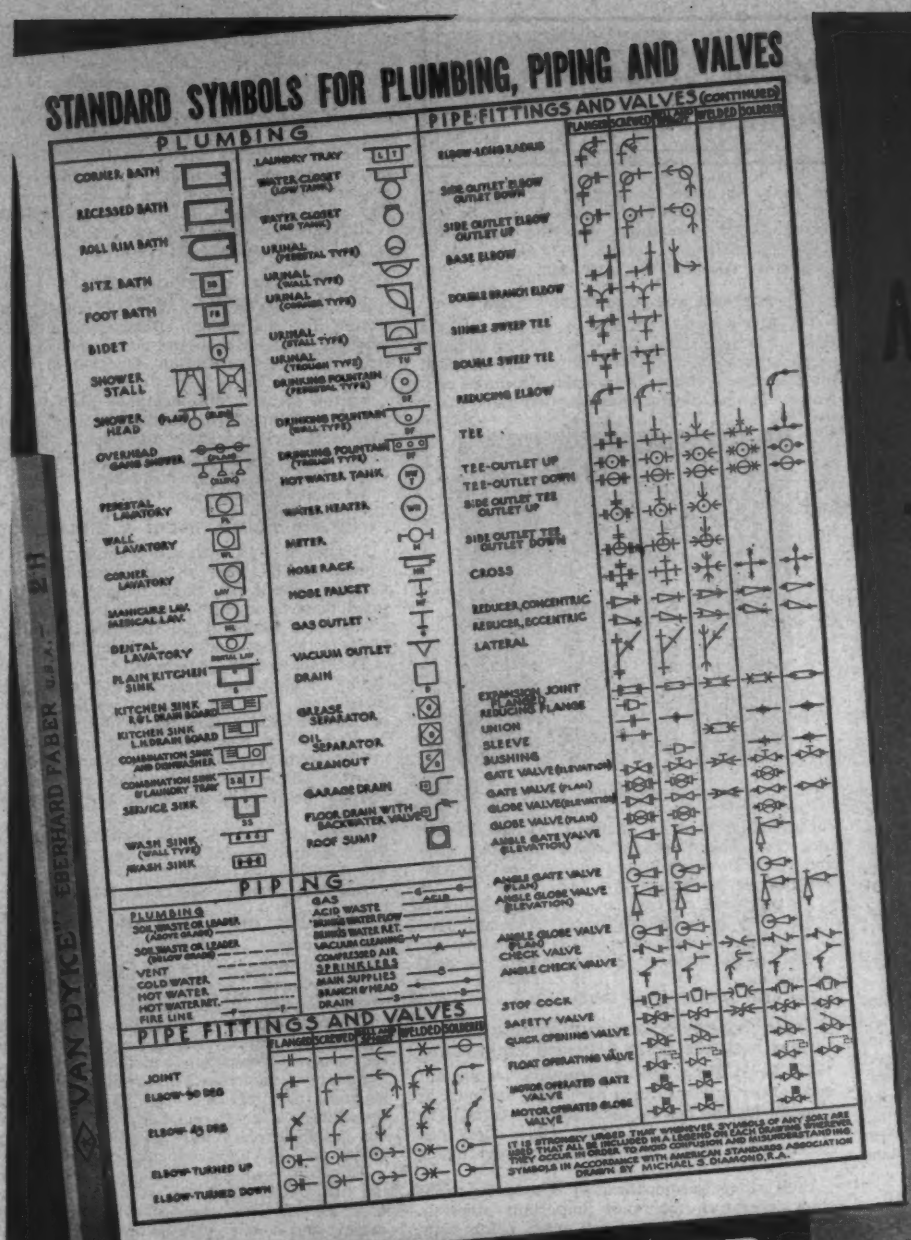
DRAWING BOARD — size to be specified by instructor
DRAWING INSTRUMENTS — as specified by instructor
ERASING SHIELD
IRREGULAR CURVE — Nos. 8 and 13, transparent
PENCIL COMPASS
PENHOLDER — for lettering pens
PENS — assorted, for lettering
PROTRACTOR — not over 5 in.
SCALE — 12 in. architects', triangular
SCALE GUARD
SLIDE RULE — 10 in., as specified by instructor
T SQUARE — to fit drawing board
TRIANGLES — 30–60 deg., 10 in. transparent, and 45 deg., 8 in. transparent

Drafting Supplies

BICHROMATE OF POTASH — crystals
BLUEPRINT
a) Paper, 36 in. wide
b) Writing fluid
PAPER
a) Cross section, 8½ by 11 in.
b) Detail, 24 by 36 in.
c) Drawing, 24 by 36 in.
d) Isometric, 7 by 10 in.
e) Tracing, 36 in.
POWDER — for tracing cloth
TRACING CLOTH — 36 in.
VAN DYKE
a) Fixing salts
b) Paper, 36 in.
c) Writing fluid

Drafting—Additional Supplies

To be provided by, or for, each student
ERASERS
a) Cleaning
b) Ink
c) Pencil
INK
a) Black, waterproof
b) Colored, if required
PENCILS — DRAWING, HB, 2H, 3H, 4H, and 6H
PENCIL POINTER PAD
THUMBTACKS OR SCOTCH TAPE


STANDARD SYMBOLS FOR PLUMBING, PIPING AND VALVES
PLUMBING
PIPING
PIPE FITTINGS AND VALVES
PIPE FITTINGS AND VALVES (CONTINUED)
"VAN DYKE" EBERHARD FABER U.S.A. 2H

Still More Help for Mechanical Drawing Teachers!

EBERHARD FABER continues in 1945 the WALL CHART REFERENCE series made possible by the ever increasing demand for MICROTOMIC VAN DYKE Drawing Pencils . . . Whether or not you have previously started posting these charts in your classroom, here is your opportunity to requisition the new No. 7 Chart shown here . . . It's FREE to accredited teachers – just clip the coupon, and mail.

Actual size 16½" x 26½"

EBERHARD FABER

LEADERSHIP IN FINE WRITING MATERIALS SINCE 1849

MICROTOMIC VAN DYKE helps develop student's pride by keeping drawings smudge free. The "H" degree is hard enough yet permits clean erasures.

EBERHARD FABER, Dept. IA-3, 37 Greenpoint Ave., Brooklyn 22, New York
Please send me *without charge* your No. 7 Wall Chart "Standard Symbols for Plumbing, Piping and Valves"

Name of teacher _____

Name of school Detroit Public Library

Street and Number _____

City and State _____

Shop Equipment News

New Products—Publications

ECONOMY SET OF GAUGE BLOCKS

An economy set of 37 DoAll gauge blocks is now available in two qualities from Continental Machines, Inc., 1301 Washington Ave. So., Minneapolis 4, Minn. These gauge blocks are packaged in the newly designed pocket carrying case, which holds the blocks on end for ease in handling and identifying. The case measures 7½ by 4 by .2 in., to fit easily in the inspector's shop-coat pocket ready for instant use.

Economy gauge blocks

The set includes two .050 wear blocks in addition to the five standard series of gauge blocks regularly offered. The addition of the .050-in. size makes the complete set more versatile.

The first series consists of 9 blocks: .1001 in. to and including .1009 in. in increments of .0001 in.

The second series is 9 blocks: .101 in. to and including .109 in. in increments of .001 in.

The third is 9 blocks: .110 in. to and including .190 in. in increments of .010 in.

The fourth is 5 blocks: .100 in. to and including .500 in. in increments of .100 in.

The fifth is 3 blocks: 1.0 in., 2.0 in., and 4.0 in.

All blocks are made from special analysis steel to give long wearing quality. Each block is scientifically heat-treated, seasoned, and processed to insure the absence of internal stresses, warping, growth, or shrinkage. Each block has a hardness of 65 rockwell "C" and is clearly etched showing its dimensional size and serial number.

For brief reference use IAVE—310.

A VERSATILE DRAFTING BOARD

The Engineering Manufacturing Co., Sheboygan, Wis., has just perfected a drafting board with a number of useful features.

It consists of a one piece drawing surface on a swivel top. The edges of this working top are square and true, and the top can be swiveled through the entire 360 deg. The board is equipped with permanent spring tension paper clips, and the base is provided with rubber bumpers to prevent slipping.

For brief reference use IAVE—311.

POSTWAR ADJUSTABLE STEEL CHAIRS

The new Kewaunee Chair has many outstanding features. The seat height may be changed instantly to suit any individual. Four height ranges are available in either stool or chair from 12 in. to 15 in., 15 in. to 21 in., 18 in. to 27 in., 24 in. to 36 in. The shaped steel back rest may be adjusted both vertically and horizontally in relation to the seat. The most popular height range is 18 in. minimum to 27 in. maximum. This one chair gives a variance of seating heights which cover most needs. Adjustment is made by merely lifting the seat. No bolts, nuts, or screws are used. No tools are needed and adjustments are entirely automatic. Shipments may be expected shortly after the first of the year.

Kewaunee Mfg. Co., Dept. 000, Adrian, Mich.

For brief reference use IAVE—312.

PORTABLE PUBLIC ADDRESS SYSTEM

The Allied Radio Corporation, 833 W. Jackson Blvd., Chicago 7, Ill., has developed a portable public-address system, which is specially designed for general school use. The amplifier includes such features as: full 30 watts output, two individually

Portable address system

controlled microphone channels, phono channel, tone control, and optional phono top. The setup and operation have been simplified so that anyone can use the system.

Prompt delivery can be made on all orders which carry a minimum rating of AA5, approved on a WPB-541 application. WPB field offices are authorized to approve applications for essential civilian use.

For brief reference use IAVE—313.

DE VILBISS OFFERS CONDITIONING TABLE TO HELP USERS PRESERVE SPRAY-PAINTING EQUIPMENT

To help users of spray-painting equipment make thier present units last just as long as possible in the face of wartime shortages, The DeVilbiss Company, Toledo, Ohio, has just issued a concise, easy-to-follow Conditioning Table.

Illustrations accompanied by simple directions show operators the most important steps to follow in caring for spray guns, paint cups, hose, transformers, air compressors, spray booths and exhaust fans.

Pioneer manufacturer of spray-painting equipment, DeVilbiss is offering its Conditioning Table without charge to all users of such equipment. DeVilbiss distributors everywhere now have supplies.

Many users of spray-painting equipment already following the new Conditioning Table have reported highly satisfactory results.

For brief reference use IAVE—314.

THE KUPFERMAN TRAINER

The Kupferman Trainer is a sturdy, foolproof, easily constructed and inexpensive device for the teaching of aviation. It can be made from simple plumbing and hardware parts which are procurable in any town or city.

To operate the trainer, the student sits on a stool and holds the stick to the top of which is attached the plane. It has a plastic panel board with photographically accurate dial faces and movable metal dial arrows which can be set to simulate any flight condition. The rudder below is operated by the student's feet. The slightest change of stick and rudder position away from neutral changes the position of the plane, while the ailerons, elevators, and tail also move, just as in a real plane. The speed of the motor to which is attached a plastic propeller enclosed in a wire cage for protection is controlled by a rheostat and a switch on the panel board.

The inventor, who is an instructor in the New York City high schools, has successfully used the trainer on more than 250 students daily for the past year, and the results are very encouraging.

The entire device can be made for less than ten dollars, and dependable and accurate plans to construct the trainer are $2.50. Address all inquiries to R. Kahn, 1819 Avenue L, Brooklyn, N. Y. Money orders only are acceptable.

For brief reference use IAVE—315.

WALL CHART OILSTONES

A three-color wall chart on "Industry's Oilstones" for sharpening, honing, and filing has been prepared for shop and classroom use by the Behr-Manning Corporation, Division of Norton Co., Troy, N. Y.

Norton abrasive oilstones have played an important part in war production, and will do likewise in the reconstruction and postwar period.

Your copy will be mailed to you if you mail your request to the aforementioned firm.

For brief reference use IAVE—316.

FACTS AND FIGURES ABOUT A VERSATILE TOOL

Precise 35 is a high-speed electric hand tool which can be used to drive small mounted abrasive wheels, or small milling cutters, and small diameter drills for doing a thousand-and-one jobs of grinding, finishing, and touching up work in the shop and on the assembly line.

The tool weighs 35 ounces, is powered by a ⅛ h.p. motor, and runs at 35,000 r.p.m. Accessories that may be obtained with this little machine include a Coolflex flexible shaft and a 24-piece set of mounted wheels, and a 20-piece ground-from-the-solid midget milling cutters of assorted shapes. It can be used on steel, nonferrous metals, plastics, glass, and many other materials.

Write for the 16-page booklet, "Facts and Figures," fully describing this tool. Precise Products Co., Racine 3, Wis.

For brief reference use IAVE—317.

CATALOG ON MILLING AND GRINDING MACHINES

The Cincinnati Milling and Grinding Machines, Inc., Cincinnati, Ohio, announce the third yearly edition of their general catalog, No. M-995-2.

The new catalog contains the following: brief history of Cincinnati milling; milling machines for general production; milling machines for automatic production; attachments for milling machines; cutter and tool grinders; surface broaching machines; center-type grinders; centerless grinding machines; centerless lapping machine; and attachments for grinding machines.

This firm also has published a booklet under the title "Interesting Applications of the Cincinnati No. 2 Cutter and Tool Grinder." Both catalog and booklet may be obtained by addressing the Cincinnati Milling and Grinding Machines, Inc., Cincinnati 9, Ohio.

For brief reference use IAVE—318.

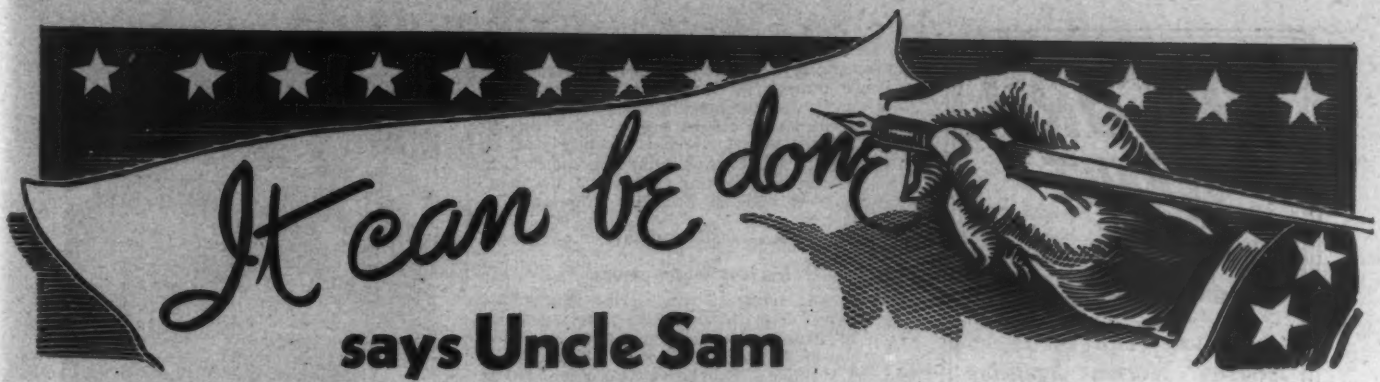
NEW "QUALITY CONTROL" HANDBOOKS

Quality Control is the title of the new pocket size handbook on scientific inspection which has just been released by Continental Machines, Inc., 1301 Washington Ave. So., Minneapolis 4, Minn., manufacturers of precision measuring instruments.

This new handbook contains concise explanation of scientific inspection through controls offered by precision measuring instruments. The use of over 200 photographs, diagrams, charts, and tables make the information in the book very clear. Of great interest are the many conversion tables and measuring data which give pertinent information for the precision measuring methods required in scientific inspection.

One section contains 35 subjects showing how to use the precision measuring instruments. Among the precision instruments and methods shown are the new mobile inspection units, sine bars, vernier gauges, optical flats, comparator gauges, and the like. Another section of the book contains 64 key questions, along with their answers which serve both as a check and test of the knowledge gained by the reader in studying this handbook.

(Continued on page 82A)



It Will Be Done!

Answer America's Schools

★ Returning service men and women must be able to avail themselves of the finest training in their chosen peacetime vocations. The vast G.I. Program has been planned that way.

The burden of this training rests with the Schools of America—in big cities and small towns.

To do the training job right Uncle Sam is ready to help your school install a training department, or adequately equip one already in operation.

To assist you in planning such a department, the Brodhead-Garrett planning experts are at your service. Write us your problems, and your needs. For machines, equipment and supplies—order from your B-G catalog. To expedite deliveries, send **complete** order of all your needs at one time.

BRODHEAD-GARRETT CO.

"Supplying Defense Training Needs to Schools in All 48 States"

CLEVELAND, OHIO

CONCORD SERVICE is unsurpassed

SO SAY LEADERS OF
Industry · Wartime Agencies
Laboratories · Schools

RADIO AND ELECTRONIC PARTS AND EQUIPMENT

Tens of thousands of enthusiastic customers are proof of Concord leadership. *We can supply* you with anything from a single capacitor to complex laboratory installations. *Two strategically-located* Concord stores—Chicago and Atlanta—are geared for speedy action.

SENSITIVE RELAY . . .
Fully adjustable sensitive relay with 2000 ohm coil. Ideal for plate circuit or photocell applications. Minimum pull-in current only 2.5 milliamperes. SPDT Contacts.
MA10-C113 Your cost, each . . $4.75

THERMAL TIME DELAY RELAY . . .
Leach Type 1054T with 375 ohm 24 volt DC coil. Delay adjustable from 20 seconds to 1 minute. ½" fine silver DPST contacts, normally open, will handle 50 amps at 12 volts DC, 25 amps at 24 volts DC, or 6 amps at 110 volts AC.
MA10-C121 Your cost, each . . $3.35

FREE! Special 16-page Supplement of "hard-to-find" and urgently needed parts and equipment. All items are ready for immediate delivery . . . but are, naturally, subject to prior sale.

CONCORD RADIO

MAIL THIS COUPON
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901 W. Jackson Blvd., Chicago 7, Ill., Dept N-35
Please rush me the 16-page "Special Supplement" published by the CONCORD RADIO CORPORATION.
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ADDRESS _____
CITY _____ STATE _____

CONCORD RADIO CORPORATION
Lafayette Radio Corporation
901 W. Jackson Blvd. CHICAGO 7, ILL.
265 Peachtree Street ATLANTA 3, GA.

(Continued from page 80A)

The book is dedicated to Eli Whitney, the father of mass production, whose invention for interchangeability of parts has become highly developed through the use of precision measuring instruments to interpret fine dimensions.

Supplementary information in the form of films, charts, etc., are offered in the book as further training aids on scientific inspection which can be secured by writing Continental Machines, Inc., 1301 Washington Ave. So., Minneapolis 4, Minn.

For brief reference use IAVE—319.

MULTIPLE V-BELT DRIVES

A booklet giving 19 reasons why multiple V-Belt Drives form the dominant power transmission of industry has been prepared under the direction of the Engineering Research Committee of the Multiple V-Belt Drive Association, 140 S. Dearborn St., Chicago 3, Ill.

The booklet is strikingly illustrated, and the information tersely and clearly given.

For brief reference use IAVE—320.

A BOOKLET ON LIGHTING

A special booklet for lighting engineers, featuring a set of charts containing illumination values based on various spacings and mounting heights may be obtained by writing to Wabash Appliance Corporation, Birdseye Lamp Sales Division, 345 Carroll St., Brooklyn 31, N. Y.

Ask for booklet No. 1-545.

For brief reference use IAVE—321.

MASTER MANUAL FOR WOODWORKERS

An interesting book for those who work with wood. It contains considerable descriptive matter on sources of rare woods, veneering, identifying woods, application of borders and inlays, and the finishing of woods.

Besides the afore-mentioned, the book contains a very complete catalog of the various kinds of wood, veneers, adhesives, inlays, plywoods, finishing materials, tools, blueprints, and a number of tempting bargain offers.

Get a copy of this excellent catalog by writing to Albert Constantine, Jr., 797 East 135th St., New York City.

For brief reference use IAVE—322.

PRECISION MACHINING METHOD

The new precision machining method made possible by the Wet-Dry Belt Surfacer developed by Porter-Cable Machine Co., Syracuse 8, N. Y., is well described in their booklet entitled "A New Precision Machining Method." This 31-page brochure fully explains the advantages of the new surfacer. It also illustrates many actual applications to industrial products made of a variety of materials.

Another 8-page pamphlet gives a full description of the machine itself. This last mentioned pamphlet also gives many examples of the amount of time which this precision machining method has saved and the extraordinary accuracy it has made possible since it has been put on the market.

For brief reference use IAVE—323.

HENRY N. FRANKENFIELD

After two years' service in the army, including some exciting experiences in the Persian Gulf Operations, Mr. Frankenfield has returned to Hunt Pen Co., Camden, N. J., to resume his work as developing engineer.

Mr. Frankenfield will be remembered for his interesting and instructive books on linoleum block printing and his development of this subject for art education in the schools.

RECEIVE FOURTH ARMY-NAVY AWARD

Employees of Skilsaw, Inc., Chicago, manufacturers of portable electric tools, have received for the fourth time the Army-Navy production award for high achievement in the production of war materials. This fourth citation, received January 6 from Under Secretary of War Robert P. Patterson, adds a third white star to the company's "E" flag as a symbol of continued achievement in producing essential war materials.

OREGON

a wonderful place to live and make a living!

Oregon offers a mild, invigorating year-round climate; a wonderland of scenic beauty. Resorts are plentiful amid its mountains and forests; on streams and lakes. Recreation spots dot mile after mile of its seacoast.

Cordial Oregon folk offer a sincere and hearty welcome to newcomers seeking a better place to live and work and play. Here is a state where you will find ample opportunities for a teaching career.

Typical of its friendly, forward-looking people are Oregon's progressive cities. Examples: Baker, in the heart of Oregon's mining country; Pendleton, famed for its colorful Round-Up; Roseburg, a great lumber center; and Portland, fourth largest city on the Pacific Coast, famed for its beautiful gardens, its high percentage of individual homes and its progressive thinking.

All offer unusual opportunities for the pursuit of a broadened career in the field of education.

If you are interested in learning more about present teaching opportunities in Oregon, write Rex Putnam, Oregon State Superintendent of Public Instruction, Salem, Oregon, mentioning the grades for which you are qualified.

This advertisement is published in the interest of the great Oregon country by

The OREGON JOURNAL
PORTLAND, OREGON
Afternoon and Sunday
If you lived in Portland you'd read The Journal

Huther Bros. Saw Mfg. Co., Inc.

1290 University Ave., Rochester, N. Y.

Manufacturers of

Circular Saws, Groovers, Band Saws

Huther Bros. Saws are the result of more than sixty years' successful and uninterrupted experience in the manufacturing of saws. Each saw embodies the highest type of workmanship and is backed by a guarantee to be as free from flaws and seams as possible. Complete catalog on request.

Dado Head

Our dado head developed from our own patents cuts grooves with or across grain, smooth, sharp sides, grooves from ⅛" up to 4" and over. Easily adjustable. Consists of 2 outside Cutters ⅛" thick and inside cutters to make desired cut. Inside cutters in 1/16", ⅛" and ¼" thicknesses. These Groovers make a perfect cut and leave the bottom smooth.

Saw Vise

Setting Stake

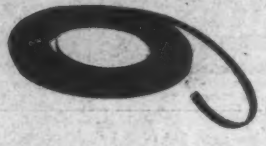
These are useful articles for the filing room and were both developed for use in our own filing department. Vise is easily adjusted for various bevel filing and takes saws up to 18" diameter.

High Speed Knives

Shaper Stock, Ground Flat Stock

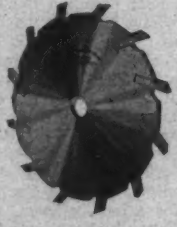
We manufacture thin High Speed Steel Knives, Solid Moulder Knives from High Speed Steel or Special Laid Steel. We can also furnish ground stock in various thicknesses and widths, square edges, in High Speed or best quality Tool Steel.

Band Saws



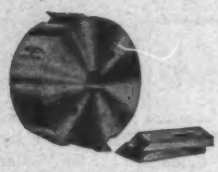
We make both wood and metal cutting band saws, also special temper saws for fibre, bakelite and soft metals. Let us know what you cut and we can furnish a saw for the purpose.

Inserted Tooth Groover



This is the perfect Groover for end grain cuts in hard wood. Teeth are High Speed Steel, front to back clearance, and require grinding on top only. Cuts full width groove through life of teeth. Teeth can be replaced.

Cutter Heads for Saw Mandrel



Cutter Heads for use on saw table. These heads can be furnished with variety of knives and used for jointing and running light moulding on saw table. Made in 6" diameter, 2¼" wide. Can be counterbored if necessary.

Mitre Saws

Our Mitre Saws are accurately ground with the proper side clearance and are made in six styles of tooth shape. Cleaner Tooth Saws are for both rip and cross-cut—made in diameters from 4" to 24".

WALLACE
"MACHINE-OF-THE-MONTH"

No. 28 SHAPER

2 H.P. geared motor rotates spindle 10,000 r.p.m.

Reversing switch, Capacity for large cutters up to 2¾" wide. Vertical spindle adjustment 1½". Collet for routing bits extra.

For fast, smooth shaping work, this 10,000 r.p.m. gear-drive Shaper is without equal! Cutters and knives available for every kind of moulding and shaping operation. Adapter and collet permits use of small routing bits and cutters, adding extra versatility.

Cuts equally well with and against grain and on hard or soft wood.

Write today for detailed bulletins and prices on the Wallace No. 28 Hy-Gear Shaper. We also manufacture quality Universal Saws, Radial Arm Saws, Bandsaws, Jointers, Mortisers, Lathes, Oilstone Grinders, etc.

J. D. WALLACE & COMPANY
140 S. CALIFORNIA AVE. CHICAGO, ILL.

An ARM
CAN DELIVER
UP TO
15 TONS
PRESSURE

Exclusive Famco gib adjustment keeps ram aligned, compensates for wear, eliminates "shimmy."

Train your students on Famco Arbor Presses . . . the low cost solution for thousands of assembly and dismantling jobs. They require no electric power, yet are easily operated even by women. They're available in 32 ruggedly constructed models, (for bench or floor mounting), in plain lever, simple ratchet or combination compound and simple ratchet types. See a Famco dealer or write today for catalog.

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(Continued from page 74A)

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New Publications

Methods of Vocational Guidance

By Gertrude Forrester. Cloth, 460 pages, 5⅞ by 8⅝ in., illustrated. Price, $3. D. C. Heath & Company, Boston, Mass.

This book has been prepared to assist the teacher of business subjects to act as vocational guidance counselors to their students who are trying to fit themselves into the business world.

Effective Foremanship

Edited by Harold B. Maynard. Cloth, 263 pages, 6¼ by 9¼ in. Price, $2.50. The McGraw-Hill Book Company, New York City.

This book is the outcome of the work of 15 experts who have combined their collective thinking in order to help the man who is taking up the duties and responsibilities which rest on a foreman's shoulders. It also serves as a text for experienced foremen who want to improve themselves.

Fundamental Business Law

By Jay F. Christ. Cloth, 332 pages, 5¾ by 8½ in., illustrated. American Technical Society, Chicago, Ill.

An introduction to the laws governing contracts, agent and principal, partnership and corporations, personal property, negotiable instruments, real property, insurance, and employer's liability.

Milling Machine Operations

By Lewis E. King. Paper, 123 pages, 5⅜ by 8⅜ in., illustrated. Price, $1.75. The Macmillan Co., New York, N. Y.

Step-by-step descriptions of operations that can be performed on the milling machine. The book describes the machine and its attachments; how to adjust cutting speeds and feeds; how to do plain milling; end milling; sawing; indexing; form, angular, and helical milling; drilling; reaming; and boring.

The book also contains tables on the various sizes of standard tapers.

Popular Tools and Materials

By William H. Johnson and Isadore M. Fenn. Cloth, 128 pages, 7 by 9¼ in. Price, $1.50. Albert Whitman & Company, Chicago, Ill.

A book for young students, which contains brief but clear descriptions of the tools, fasteners, and materials most commonly used in the elementary school-shop classes and in the home workshop.

The book is well illustrated.

Care and Use of Hand Tools

By Raymond R. Toliver. Cloth, 93 pages, 5⅛ by 8⅛ in., illustrated. Price, $1.25. John Wiley & Sons, Inc., New York City, and Chapman & Hall, Ltd., London.

Descriptive matter on the use and care of the tools commonly used by the machinist. Among the tools described are: vises, hammers, cold chisels, files, screw drivers, hack saws, pliers and nippers, wrenches, torque wrenches, taps, drills, reamers, and measuring tools.

The book also contains a demonstration and discussion guide.

Permanent Learning

By W. H. Lancelot. Cloth, 221 pages, 5¾ by 8½ in. Price, $2.25. John Wiley & Sons, Inc., New York, and Chapman & Hall, Ltd., London.

A good book for the beginner as well as for the experienced teacher.

It shows the necessity of getting the student's interest aroused, helps him to understand clearly, and then devises means for him to apply his knowledge frequently.

The final chapter presents in brief résumé form the techniques which the teacher finds useful in his daily work of instructing his students.

Needed — Women in Aviation

By Dickey Meyer. Cloth, 219 pages, 5⅛ by 7¾ in., illustrated. Price, $2. Robert M. McBride & Company, New York, N. Y.

Authoritative information about the role women can play in the field of aviation. They are needed as pilots, flying instructors, radio operators, in airplane factories and offices, as ground mechanics, draftsmen and designers, to say nothing of such jobs as hostesses and dietitians.

The book is an excellent direction pointer for all women who are anxious to enter the field of aviation.

Careers in Safety

By Herbert J. Stack, Charles C. Hawkins, and Walter A. Cutter. Cloth, 152 pages, 5⅛ by 7½ in. Price, $1.50. Funk and Wagnalls Company, New York and London.

A book of guidance for those who want to work in the field of safety. The book gives an account of where positions may be found, describes the work of the safety engineer, tells of the opportunities in safety education, and outlines the work of the industrial hygienist and describes occupational diseases.

Opportunities for the safety engineer in private organizations, insurance companies, governmental agencies, and in the armed forces also are described.

The College and Teacher Education

By W. Earl Armstrong, Ernest V. Hollis, and Helen E. Davis. Cloth, 311 pages, 6⅛ by 9¼ in. Price, $2.50. American Council on Education, Washington, D. C.

This report presents the findings and conclusions of a cooperative study entered into by approximately fifty individual colleges, universities, and public school systems, to ascertain how the preparation of teachers could be improved.

(Continued on page 86A)

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HOW TO OPERATE A LATHE
By John T. Shuman and Lewis H. Bardo

A guide for the training of students in machine shop practice. Presents factual material clearly, concisely, in easy-to-grasp question-and-answer form. Contains tables, charts, worked-out examples, decimal equivalents, diagrams. 161 Pages, Profusely illustrated, $1.75

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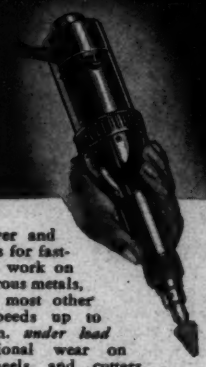

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(Continued from page 84A)

Conference Leader Training

By Edward S. Maclin and Paul T. McHenry. Cloth, 77 pages, 5½ by 8¼ in. Price, $2.50. Published by National Foremen's Institute, Inc., Deep River, Conn.

A very practical exposition of how the conference method can be made to serve as a valuable aid in the training of foremen and supervisors.

Airframe Materials

By F. S. Stewart. Cloth, 237 pages, 5⅜ by 8½ in., illustrated. Price, $4. McGraw-Hill Book Co., New York City.

A book which discusses the properties of materials used in the manufacture of airplane frames. It describes the methods of testing, gives the comparison of properties of the various kinds of materials, describes the heat-treatment required by some of them, the effects of cold-working others, corrosion and aging of some, cleaning and chemical treatment of others, bonding processes used for joining them, adhesives used for veneers and plywood, plastic compositions and transparent plastics.

The Chemical Industry

By Josephine Perry. Cloth, 128 pages, 6¼ by 8¼ in., illustrated. Price, $1.75. Published by Longmans, Green & Co., New York, N. Y.

This, the eighth volume of the *America at Work* series, gives an excellent account of how the chemical industry has expanded in our country within the past two or three decades. The book also describes the vital part this industry has played in the present world conflict.

The story of the production of synthetic products such as nylon, neoprene, and the many varieties of plastics and synthetic dyes is interestingly told.

Woodworking Projects for Industrial-Arts Students

By Gerald Baysinger and Hartley H. Schaal. Cloth, 149 pages, 5⅞ by 9 in., illustrated. Price, $1.40. Published by McGraw-Hill Book Co., New York, N. Y.

This book contains 21 projects that will interest almost any industrial-arts boy. It also contains directions for making a 12- and 16-in. model sailboat, and suggestions for conducting a model sailboat race. An experimental procedure for improving the sailing qualities of a model boat also has been inserted.

Vocational-Technical Training for Industrial Occupations

Paper, 306 pages, 5⅞ by 9⅛ in. Price, 40 cents. For sale by the Superintendent of Documents, Washington, D. C.

A report of the survey submitted by a committee of industrial and educational leaders called together by John W. Studebaker, U. S. Commissioner of Education, to advise concerning objectives and standards of training in a new area of vocational education of less than college grade.

Electrical Drafting

By D. Walter Van Gieson. Cloth, 140 pages, 5¾ by 8⅜ in., illustrated. Price, $1.50. McGraw-Hill Book Co., New York, N. Y.

The author has wisely refrained from making his book just another engineering drawing text. Instead he has confined his book to an exposition of drafting methods as applied to circuits and wiring diagrams for use in the fields of lighting, communication, power transmission, and the like.

The book contains a very comprehensive list of electrical symbols used by the draftsman.

Vocational and Professional Monographs — Secretarial Science

By Mildred J. Langston. Paper, 23 pages, 6 by 9 in. Price, 50 cents. Bellman Publishing Co., Inc., 6 Park St., Boston 8, Mass.

One of a series of occupational booklets discussing needed personal qualifications and scholastic training, employment opportunities, remuneration offered, advancement possibilities, and advantages and disadvantages of a given trade or occupation.

Manual of Aircraft Layout

By Rudolph Faltus and Charles Steinmetz. Paper cover, 240 pages, 8½ by 11 in., illustrated. Price, $3. John Wiley and Sons, Inc., New York City, and Chapman and Hall, Ltd., London.

This book aims to serve as a textbook for the learner and as a reference book for the mechanic. It shows the beginner how to read blueprints, tells him what tools and instruments are used by the layout man, initiates him in the art of making template layouts, and presents problems which will give him the skills which the layout man must possess.

The book also contains a number of useful charts and tables.

Occupational Briefs

Published by Science Research Associates, 228 So. Wabash Ave., Chicago 4, Ill. Price, 15 cents each.

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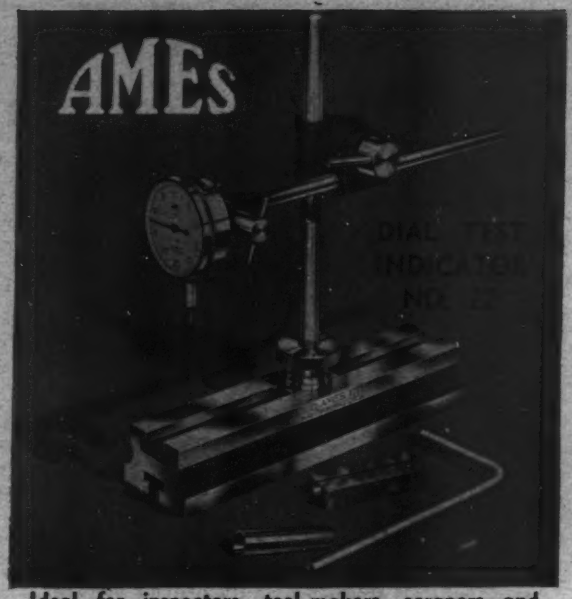

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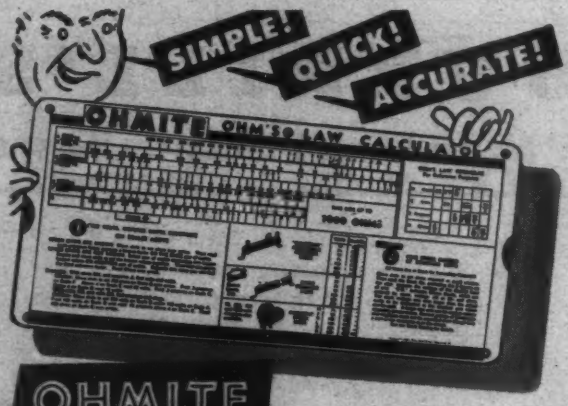

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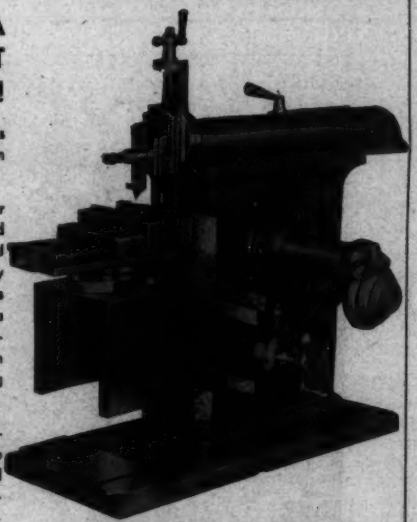

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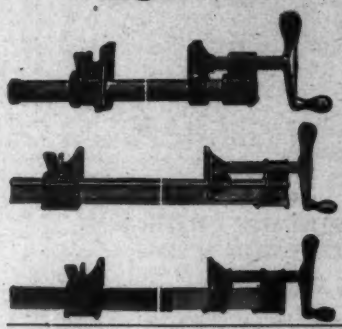

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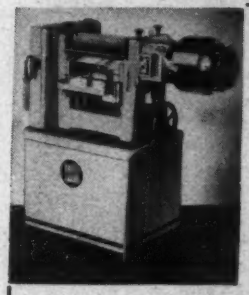

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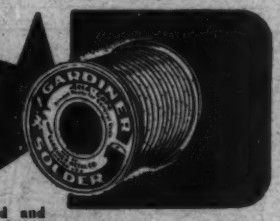

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Because of incomplete stocks, we suggest that when writing orders you include a second and third choice when possible. This cooperation would be to your advantage and assist us in giving your orders quicker and more efficient service. Also, please include preference rating

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Sealacell Varnowax G. F. Finish
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A Semi-penetrating Water Repellent Sealer Finish Ideal for

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Bed tables — Trays — Canes — Crutches.

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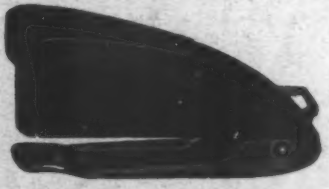
Investigate these Star Tools

Use inexpensive staple tacks. List Price, $3.00

STAR AUTOMATIC TACKERS
The Best Way to Tack Things

Used in industrial production work. Tack upholstery, wire screens, shades on rollers, dozens of other uses. Easy to operate — just squeeze the handle. Hold material in place with one hand, tack it with the other. Tack within 1/16" of an edge and in close quarters where you can't swing a hammer.

STAR Model S122P Stapler



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Swing the base down and around and it becomes a light duty tacker. Fine for tacking up charts, pictures and papers on walls, drawings on drawing boards.

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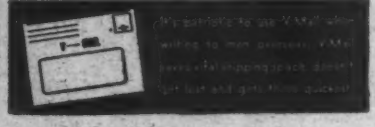

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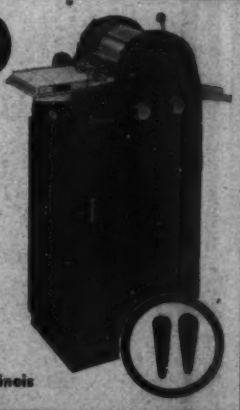

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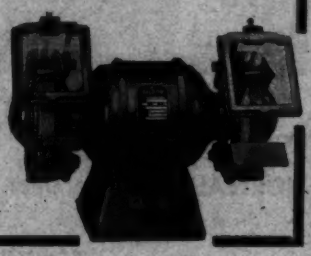

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Industrial Arts and Vocational Education Subscriber's Service

We invite inquiries and questions on all problems relating to the organization, planning, and equipping of your school shops. For equipment and supplies the advertising of manufacturers in this issue will serve as a convenient guide, and your requests to these advertisers will bring immediate response.

Use the post card on this page. It will promptly bring from the manufacturers the information requested. A "keyed" alphabetical list of supplies and equipment is given for ready reference and your convenience. Insert the key number of any products in which you are interested, sign, detach, and mail the card — no postage is required if mailed in the United States. *For items of equipment or supplies not included in list please write us a special letter; or include item after "Remarks" on post card, as we can put you in touch with all sources of supply.*

This service is limited to supervisors, shop instructors, and officials responsible for the specification and purchase of equipment and supplies in school shops.

KEYED PRODUCT CHECKING LIST FOR SOURCES OF SUPPLY

If You Desire Catalogs, Information, or Have Any Questions On Two or More of These Products Write the "Key Number" On the Post Card, Sign, and Mail to Us.

1—Abrasives, Cloth—Belt
2—Abrasives, Grain
3—Abrasives, Paper
4—Abrasives, Waterproof
5—Acid Swabs and Brushes
6—Aluminum, Bars, Sheets
7—Aluminum, Oxide Cloth
8—Ammeters
9—Anvils
10—Anvil Tools
11—Aprons, Shop
12—Arbor Presses
12a—Arc-Welding sets and equipment
13—Archery Equipment
14—Art Metal Tools
15—Asbestos Soldering Blocks
16—Auto Mechanics' Tools
16a—Automotive Test Equipment
17—Auto Trailer Plans and Parts
17a—Axes
18—Babbitt Metal
19—Band Saws
20—Band Saw Blades
21—Band Saw Brazers
21a—Band Saws, metal cutting
22—Band Saws, Portable
23—Band Saw Sets
24—Bar Iron
25—Basketry Supplies
26—Battery Chargers
27—Belting
28—Benches
29—Bench Legs, Metal
30—Bench Metal
31—Bench Stones
32—Benches, Manual Training
33—Benches, Stake Plate
34—Bench Vises
35—Blackboard Drawing Sets
36—Blacksmiths' Tools and Supplies
37—Blowers and Compressors, Air
38—Blow Pipes, Brazing, Jewelers'
39—Blowtorches
40—Blowers, Forge
40a—Blue-Print Cabinets
41—Blue-Printing Machines, Electric
42—Blue-Print Paper & Cloth
43—Books (Specify Subject)
44—Bookbinders' Supplies
45—Borers, Wood
46—Braces and Bits
47—Brass, Sheets, Bar
48—Brass Furnaces, Gas
49—Brazing Torches
50—Bristol Board
50a—Brittania Metal
51—Bronze Sheets, Bars, etc.
52—Brushes, Artists'
53—Brushes, Circular, Bristle and Wire (All Kinds)
54—Brush Conditioner, Paint
55—Brushes, Paint and Varnish
56—Brush Making Materials
57—Buffers, Bench, Pedestal
58—Buffs, Polishing
59—Bushing Removers
60—Cabinet Hardware
61—Cabinets, Filing
62—Cabinets, Storage (State Kind)
63—Calipers
64—Cane for Chairs
65—Carving Tools (Specify Kind)
66—Casting Outfits
67—Castings, Project
68—Carved Wood Moldings
69—Cements, Jewelers'
70—Ceramics
71—Charcoal Blocks
72—Charts
73—Chasing Tools
74—Chisels (State Kind)
75—Chucks, Independent, Universal, Combination
76—Chucks, Drill
77—Circular-Saw Benches
78—Clamps
79—Clamps, Bar
80—Clay, Natural
81—Clock Movements
82—Conduits
83—Coping Saws
84—Coping Saw Blades
85—Copper, Sheets, Bars
86—Core Ovens
87—Countersinks
88—Crucibles
89—Cut-off Saws
90—Cutter Heads
91—Cylinder Printing Presses
92—Dado Heads
93—Decalcomania
94—Desks, Teachers'
95—Die Makers' Supplies
96—Dowel Pointers
97—Doweling Jigs
98—Drafting Tables
99—Drafting Instruments
100—Drawing Inst. Repair Parts
101—Drawing Boards
102—Drawing Paper — Equipment and Supplies (State Kind)
103—Draw Plates
103a—Drilling Machines
104—Drill Presses
105—Drill Sharpeners
106—Drill Stands, Bench, Post, Pedestal
107—Drills
107a—Duplicators
108—Dynamometers, Electric
109—Electric Generators
110—Electric Motors, Power Units
111—Electric Motors, Construction Sets
112—Electrical Instruments
113—Electrical Parts and Supplies
114—Emery Paper, Cloth and Powder
115—Enamels
116—Engravers' Tools and Supplies
117—Envelopes
118—Exposure Meters
118a—Fasteners, staple
119—Felt, Cloth
120—Felt Wheels and Buffs
121—Fiber Cord
122—Files and Rasps

The School Shop Service Bureau will save your time and the expense of writing to individual firms to establish convenient and reliable sources of supply. We urge the use of this Service Bureau. Additional cards may be had on request.

INFORMATION WANTED

We are interested in the following items as checked below, and will appreciate receiving the information requested, promptly.

☐	☐	☐	☐	☐	☐	☐	☐
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(Check) Catalogs.....Prices.....Information.....Manufacturer's Address....

Remarks: .....

Name .....
Please Print

Title ..... School .....

City ..... State .....

Detroit Public Library

Keyed Product Checking List for Sources of Supply: Continued

123—Filing Machines
123a—Films
124—Finishing Kits
125—Fire Brick and Cement
126—Fire Clay
127—Flasks
128—Flexible-Steel Tape Rules
128a—Flexible Shaft and Motor Outfits
129—Flexible Tubing
130—Flint Paper
130a—Flock and Flock Guns
131—Floor Sanders
132—Flux, Soldering
133—Forges, Gas
134—Foundry Supplies and Equipment
135—Frequency Meters
136—Furnace Linings
137—Furnaces, Annealing, Case-Hardening, Heat-Treating, Metal Melting
138—Furniture Finishes and Supplies
139—Furniture Trim
140—Furniture Weaving Frames
141—Fuses, Standard
142—Galvanometers
143—Garnet Papers
143a—Gas Welding equipment and supplies
144—Gauges, Printing, Cabinet, Rule and Square
145—Gauges, Wire, Etc.
146—Generator Test Benches
147—Glass Cutter
147a—Glazing Tools
148—Glue
149—Glue Pots
150—Gouges
151—Grinders and Buffers
152—Grinder Attachments
152a—Grinders, Bench
153—Grinding Compound
153a—Grinding Machines, Plain
153b—Grinding Machines, Universal
153c—Grinding Machines, Centerless
154—Grinding Wheels
155—Grinding Wheel Dresser
156—Hacksaws
157—Hacksaws, Power
158—Hacksaw Power Blades
159—Hammers
160—Handicraft Supplies
161—Hand Screws
162—Heat-Treating Equipment
163—Hinges
164—Inks, Drawing and Colored
165—Inks, Printing
166—Inlays
167—Jewelers' Tools and Supplies
168—Jig Saws and Blades
169—Jointers, Bench
170—Jointers, Hand
170a—Keene's Cement
171—Kits, Projects
172—Kits, Metal Projects
173—Knife Grinder
174—Knives, Sloyd, Manual Training, Stencil and Wood Block
175—Knives, Machine
175a—Knives, band
176—Knock-Down Furniture
177—Kraftsmen Kits
178—Laboratory Standard Instruments
179—Lacquers
180—Lamps, Alcohol
181—Lamps, Miniature
182—Lathe Attachments
183—Lathes, Metalworking
183a—Lathes, Spinning
184—Lathes, Woodworking
185—Leather-Working Tools and Supplies
186—Letters and Figures for Stamping Metals
187—Levels
188—Linoleum Blocks, Supplies
189—Looms
190—Lumber
191—Machine Lights
191a—Machinists' Tools
192—Mallets
192a—Manual Training Tools and Supplies
193—Metal Craft Tools and Supplies
194—Metal Shears, Electric
195—Metals, Sheet
196—Metal Spinning Equipment
196a—Metal Stamping Machines
197—Mica
197a—Micrometers
198—Milling Machines
199—Miter Boxes
200—Model Boat and Airplane Parts
201—Modeling Clay
202—Modeling Tools
203—Mortisers
203a—Motion Picture Machines
204—Motor Generator Sets
204a—Nippers, Cutting, Jewelers'
205—Ohmmeters, Portable
206—Oilstones, Bench
207—Outlets, Switchboxes
207a—Oxy-Acetylene sets & equip.
208—Paints, Projects Finishing
209—Panel Boards, Electric
210—Pantographs
211—Paper, Drawing and Tracing
212—Paste
213—Pencils, Drawing
214—Pencils, Electric Etching
215—Pens, Ink Shading
216—Pens, Lettering
217—Pewter
218—Picture Frame Moldings
219—Phase Angle Meters
220—Picture Frame Tools
221—Planes, Hand
222—Planers and Surfacers (Wood)
223—Plans and Directions
224—Plastic Wood
225—Pliers
226—Plywood
227—Porcelain Knobs, Cleats
228—Plastic Materials
228a—Portable Electric Drills
229—Portable Meters, Indicating
230—Portable Woodworking Machinery
231—Pottery Supplies
232—Presses, Veneer
233—Power Hack Saws
234—Printshop Equipment and Supplies
235—Protractors
236—Punches
237—Radio Parts
237a—Radio Test Equipment
238—Reeds and Raffia
239—Resistance Boxes, Plug and Dial Resistors
239a—Revolution Counters
240—Rheostats
241—Routers
242—Rubber Stamps
243—Rubber Type Sets
244—Rules, Wood, Boxwood, and Combination
245—Sanders (State Type)
245a—Sanders, Belt
246—Sanders, Portable
247—Sanding Discs
248—Sandpaper
249—Saws, Circular
250—Saw Filing Machines
251—Saw Sets
252—Saw Trimmers (Printing)
253—Saws
254—Saws, Portable Electric
255—Scrapers, Hand and Cabinet
256—Screw Clamps
257—Screw Drivers
258—Scroll Saws
259—Semi-Precious Stones
260—Shapers, Electric
261—Shapers, Metalworking
262—Sharpening Stones
263—Sheet-Metal Tools and Equipment
264—Shear Grinder
264a—Silversmith's Tools and Supplies
265—Slide Rule
266—Sloyd Knives
267—Sockets and Receptacles
268—Soldering Coppers
269—Soldering Furnaces
269a—Soldering Irons, Electric
270—Solders, All Kinds
271—Special Auto Mechanics' Tools
272—Spindle Carver
273—Spray Painting Equipment
273a—Spray Painting Booths
274—Squares
275—Stains
276—Stakes, Arts and Crafts
277—Steel, Sheets, Bar, Stainless
278—Stencils—Marking
279—Stencils—Silk Screen Process
280—Starters, Motor, Electric
281—Steel Rules
282—Steel Squares
283—Stencil Knives
284—Stools
285—Storage Battery Testing Instruments
286—Switchboards
287—Switchboxes
288—Switches, Safety
289—Tachometers, Electric
290—Tacks, Thumb, Steel, Brass
290a—Tackers
291—Tape, Measuring
292—Taps and Dies
293—T Squares
294—Tenoners
295—Thermometers
296—Test Equipment, Electrical
297—Tongs
298—Tool Boxes
299—Tool Charts
300—Tool Checks
301—Tool Post Grinders, Electric
302—Tool Grinders
303—Tool Holders
304—Torches, Alcohol, Gasoline
305—Transformers
306—Universal Saw Benches
307—Upholstery Materials and Supplies
308—Valve Regrinders
309—Valve-Spring Compressors
310—Variety Saw Benches
311—Varnish and Stains
312—Veneers
313—Vises, Metalworking
314—Vises, Woodworking
314a—Visual Education
315—Voltmeters
316—Waterproof Abrasive Papers
317—Wattmeters
318—Weaving Materials, Furniture
319—Welding Equipment, Electric
319a—Welding Equipment, Oxy-acetylene
320—Welding Equipment
321—Wheel Pullers
322—Wood Carvings
323—Wood Dyes
324—Wood Trimmers
325—Wood-Turning Lathes
326—Woodworking Shapers
327—Woodworking Tools and Supplies (State Kind)
328—Wrenches

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4th Wartime Service Edition

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Directory of Manufacturers' Products

This directory is published as a convenient guide to sources of supply covering the products of manufacturers carrying specification data in the ANNUAL NUMBER. For alphabetical index of manufacturers' advertising see page 101A. To obtain products not included in this directory, quotations or additional information to help you make up your specifications, lists of equipment, etc., address Industrial-Arts Service Division.

ABRASIVE PAPER & CLOTH
Behr-Manning Corp.
Carborundum Co., The

ADJUSTABLE CURVE RULERS
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick

AIRBRUSHES
Paasche Airbrush Co.

AMMETERS
General Electric Co.
Weston Electric Instrument Corp.

ANVILS
Atlas Press Co.
Cincinnati Tool Co.

ANVIL TOOLS
Stanley Tools

ARBOR PRESSES
Atlas Press Co.
Fauco Machine Co.

ARC-WELDING SETS & EQUIP.
General Electric Co.
Hobart Bros. Co.
Lee Co., K. O.
Linde Air Products Co.
Marquette Mfg. Co.

ARCHERY MATERIALS
Indianhead Archery & Mfg. Co.
Steinmler Co., L. E.
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ART METAL TOOLS
Metal Crafts Supply Co.

AUTOMOTIVE TEST EQUIPMENT
Weidenhoff, Inc., Joseph

AUTOMOTIVE TOOLS AND EQUIPMENT
Armstrong Brothers Tool Co.
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Kerkling & Company
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Starrett Co., L. S.
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Millers Falls Co.
Stanley Tools

AXES
Plumb, Inc., Fayette R.

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Chicago Flexible Shaft Co.

BABBITT METAL
Gardiner Metal Co.
Kester Solder Co.

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Delta Mfg. Co.
Disston & Sons, Inc., Henry
Huther Bros. Saw Mfg. Co.
Walker-Turner Co., Inc.

BAND SAW BRAZERS, Electric
Atkins & Co., E. C.
Oliver Machinery Co.

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Boice Crane Co.
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Delta Mfg. Co.
Do Wall Products Corp.
Disston & Sons, Inc., Henry
Lewis Machine Tool Co.
Ohlen Bishop Mfg. Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

BAND SAWS, METALCUTTING
Starrett Co., L. S.

BAND SAWS, PORTABLE
Boice Crane Co.
Delta Mfg. Co.
Oliver Machinery Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.

BAND SAW SETS
Atkins & Co., E. C.

BATTERY CHARGERS
General Electric Co.
Weidenhoff, Inc., Joseph

BENCH FURNACES
American Gas Furnace Co.
Chicago Flexible Shaft Co.

BENCH VISES
Atlas Press Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Lewis Machine Tool Co.
Lusky, White & Coolidge, Inc.
Millers Falls Co.
Morgan Vise Co.
Oliver Machinery Co.

BENCHES
Jewelers' and Metal Workers'
Hamilton Mfg. Co.
Sheldon & Co., E. H.

BENCHES, MANUAL TRAINING
Brodhead-Garrett Co.
Hamilton Mfg. Co.
Lusky, White & Coolidge, Inc.
Sheldon & Co., E. H.

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Snap-on Tools, Inc.
Stanley Tools

BLACKBOARD DRAWING SETS
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick
Weber Co., F.

BLACKSMITH TOOLS AND SUPPLIES
Columbian Vise
Heller Brothers

BLOWERS, FORGE
American Gas Furnace Co.
Chicago Flexible Shaft Co.

BLOWPIPES, Brazing, Jewelers'
American Gas Furnace Co.

BLOWTORCHES
Lusky, White & Coolidge, Inc.
Turner Brass Works

BLUE-PRINT CABINETS
Hamilton Mfg. Co.

BLUE-PRINT PAPER
Dietzgen Co., Eugene
Post Company, Frederick

BLUE-PRINTING MACHINES, ELECTRIC
Dietzgen Co., Eugene

BOARDS, DRAWING
Dietzgen Co., Eugene
Engineering Sales Co.
Post Company, Frederick
Weber Co., F.

BOOKBINDERS SUPPLIES
American Type Founders Sales Corp.
Pratt Co., G. A.

BOOKS
American Technical Society
Bruce Publishing Company
Dutton & Co., Inc., E. P.
Fellowcrafters, Inc.
International Textbook Co.
Macmillan Co., The
McGraw-Hill Book Co.
McKnight & McKnight
Manual Arts Press
Wiley & Sons, Inc., John

BORERS, WOOD
Delta Mfg. Co.
De Walt Products Co.
Oliver Machinery Co.
Wallace & Co., J. D.
Yates-American Machine Co.

BORING BARS
Armstrong Bros. Tool Co.
Atlas Press Co.
South Bend Lathe Works
Stokes Industries
Williams & Co., J. H.

BORING TOOLS
Armstrong Bros. Tool Co.
Atlas Press Co.
Lusky, White & Coolidge, Inc.

BOW COMPASSES, DIVIDERS, PENS, PENCILS
Dietzgen Co., Eugene
Dixon Crucible Co., Joseph
Engineering Sales Company
Post Company, Frederick
Weber Co., F.

BRACES
Millers Falls Co.
North Brothers Mfg. Co.
Russell-Jennings Mfg. Co.
Stanley Tools

BRAD AWLS
Millers Falls Co.
Stanley Tools

BRASS FURNACES, GAS
American Gas Furnace Co.
Chicago Flexible Shaft Co.

BRASS TYPE
American Type Founders Sales Corp.

BRAYERS
American Type Founders Sales Corp.

BRAZING TORCHES
American Gas Furnace Co.
Atkins & Co., E. C.

BRISTOL BOARD
Dietzgen Co., Eugene
Post Company, Frederick
Weber Co., F.

BRITTANIA METAL
Metal Crafts Supply Co.

BRUSHES, ARTISTS'
Dietzgen Co., Eugene
Post Company, Frederick

BRUSHES, CIRCULAR, BRISTLE AND WIRE (All Kinds)
Atlas Press Co.

BRUSH MAKING MATERIALS
Whiting, E. B. & A. C.

BUFFERS, BENCH, PEDESTAL
Black & Decker Mfg. Co.
Snap-on Tools Corp.
Stanley Electric Tools

CABINET HARDWARE
Brodhead-Garrett Co.
Lusky, White & Coolidge, Inc.
Stanley Works

CABINETS, Cut and Electro
American Type Founders Sales Corp.

CABINETS, Furniture, Galleys, Ink, Type, and Rollers
American Type Founders Sales Corp.

CALIPERS
Lusky, White & Coolidge, Inc.
Starrett Co., L. S.

CARVING TOOLS, for Wood and Linoleum
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Co.
Greenlee Tool Co.
Lusky, White & Coolidge, Inc.

CENTER LATHE
Atlas Press Co.
LeBlond Machine Tool Co.
South Bend Lathe Works

CERAMICS
American Art Clay Company
Brodhead-Garrett Co.
Fellowcrafters, Inc.
Western Stoneware Co.

CHASES
American Type Founders Sales Corp.

CHASING TOOLS
Metal Crafts Supply Co.

CHISELS, Cape, Cold, Grooving
Atlas Press Co.
Cincinnati Tool Co.
Disston & Sons, Inc., Henry
Lusky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

CHISELS, FRAMING, MORTISE
Greenee Tool Co.
Millers Falls Co.
Stanley Tools

CHISELS, Metal Cutting and Wood Carving
Atlas Press Co.
Disston & Sons, Inc., Henry
Greenee Tool Co.
Lusky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

CHUCKS, COMBINATION
Atlas Press Co.
Snap-on Tool Corp.
South Bend Lathe Works
Stokes Industries

CHUCKS, DRILL
Atlas Press Co.
Lusky, White & Coolidge, Inc.
South Bend Lathe Works
Walker-Turner Co., Inc.

CHUCKS, INDEPENDENT, Universal Combination
Atlas Press Co.
Boice-Crane Co.
Lee Co., K. O.
South Bend Lathe Works
Stokes Industries
Walker-Turner Co., Inc.

CIRCULAR-SAW BENCHES
Boice-Crane Co.
Crescent Machine Co.
Delta Mfg. Co.
Lewis Machine Tool Co.
Oliver Machinery Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

CLAMPS
Adjustable Clamp Co.
Armstrong Bros. Tool Co.
Atkins & Co., E. C.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Lusky, White & Coolidge, Inc.
Starrett Co., L. S.
Williams & Co., J. H.

CLAMPS, ADJUSTABLE
Adjustable Clamp Co.
Cincinnati Tool Co.
Lusky, White & Coolidge, Inc.

CLAMPS, BAR
Adjustable Clamp Co.
Cincinnati Tool Co.
Lusky, White & Coolidge, Inc.
Oliver Machinery Co.

CLAMPS, CARRIAGE, SCREW
Adjustable Clamp Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Lusky, White & Coolidge, Inc.
Oliver Machinery Co.

CLAY, MODELING
American Art Clay Co.
Western Stoneware Co.

COMBINATION SQUARES
Starrett Co., L. S.

COMPOSING STICKS
American Type Founders Sales Corp.
Rouse & Co., H. B.

CONDUITS
General Electric Co.

CONTROLLERS, ELECTRIC
General Electric Co.

COPING SAW BLADES
Atkins & Co., E. C.
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Lusky, White & Coolidge, Inc.

COPING SAWS
Atkins & Co., E. C.

COPING SAWS, Power
Delta Mfg. Co.
Walker-Turner Co., Inc.

COUNTERSINKS
Lusky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
Starrett Co., L. S.

CURVES, IRREGULAR
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick
Weber Company, F.

CUT-OFF SAWS
Atkins & Co., E. C.
Delta Mfg. Co.
De Walt Products Co.
Oliver Machinery Co.
Wallace & Co., J. D.
Yates-American Machine Co.

CUTTER HEADS
Atkins & Co., E. C.
Delta Mfg. Co.
Huther Bros. Saw Mfg. Co.
Morse Twist Drill Co.
Williams & Co., J. H.
Yates-American Machine Co.

CYLINDER PRINTING PRESS
American Type Founders Sales Corp.

DADO HEADS
Atkins & Co., E. C.
Boice-Crane Co.
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Huther Bros. Saw Mfg. Co.
Walker-Turner Co., Inc.
Yates-American Machine Co.

DISTRIBUTION TRANSFORMERS
General Electric Co.
Thordarson Elec. Mfg. Co.

DOWEL POINTERS
Lusky, White & Coolidge, Inc.
Stanley Tools

DOWELING JIGS
Lusky, White & Coolidge, Inc.
Stanley Tools

DRAFTING PENS
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick

DRAFTING TABLES
Dietzgen Co., Eugene
Engineering Sales Co.
Hamilton Mfg. Co.
Post Company, Frederick
Sheldon & Co., E. H.
Weber Company, F.

DRAFTSMENS' INSTRUMENTS
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick
Starrett Co., L. S.
Weber Company, F.

DRAWING INSTRUMENT REPAIR PARTS
Dietzgen Co., Eugene
Engineering Sales Co.

DRAWING OUTFITS
Dietzgen Co., Eugene
Engineering Sales Corp.
Post Company, Frederick
Weber Company, F.

DRAWING PAPER IN ROLLS AND SHEETS
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

DRILL PRESSES
Atlas Press Co.
Boice-Crane Co.
Brodhead-Garrett Co.
Delta Mfg. Co.
Millers Falls Co.
Porter-Cable Machine Co.
South Bend Lathe Works
Stokes Industries
Walker-Turner Co., Inc.

DRILL SHARPENERS
Atlas Press Co.

DRILL STANDS, BENCH, POST, PEDESTAL
Armstrong Bros. Tool Co.
Black & Decker Mfg. Co.
Boice-Crane Co.
Brodhead-Garrett Co.
Millers Falls Co.
Stanley Electric Tools
Stokes Industries

DRILLING MACHINES, PORTABLE ELECTRIC
Black & Decker Mfg. Co.
Chicago Wheel & Mfg. Co.
Lunsky, White & Coolidge, Inc.
Millers Falls Co.
Snap-on Tools Corp.
Stanley Electric Tools
Stanley Tools

DRILLS
Armstrong Bros. Tool Co.
Atlas Press Co.
Greenlee Tool Co.
Morse Twist Drill Co.
Snap-on Tools Corp.
Stokes Industries

DRILLS, BENCH AND FLOOR, HIGH SPEED
Atlas Press Co.
Boice-Crane Co.
Delta Mfg. Co.
Millers Falls Co.
Walker-Turner Co.

DRILLS, BREAST
Lunsky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

DRILLS, HAND
Chicago Wheel & Mfg. Co.
Lunsky, White & Coolidge, Inc.
Millers Falls Co.
North Brothers Mfg. Co.
Stanley Tools

DUPLICATORS
Dick Co., A. B.
Ditto, Inc.

DYNOMETERS, ELECTRIC
General Electric Co.

ELECTRIC WELDING EQUIPMENT & SUPPLIES
General Electric Co.
Hobart Brothers
Linde Air Products Co.
Marquette Mfg. Co.

ELECTRIC EQUIPMENT, WIRE & SUPPLIES
Ozmite Mfg. Co.
Reading Electric Co., Inc.

ELECTRIC GENERATORS
General Electric Co.
Standard Electric Time Co.

ELECTRIC MOTORS
Atlas Press Co.
Baldor Electric Co.
Boice-Crane Co.
General Electric Co.
Walker-Turner Co., Inc.

ELECTRIC SOLDERING IRONS
Lunsky, White & Coolidge, Inc.
Stanley Tools

ELECTRICAL INSTRUMENTS
General Electric Co.
Standard Electric Time Co.
Weston Electric Instrument Corp.

ELECTROTYPES
Badger American Electrotype Co.

EMERY CLOTH
Behr-Manning Corp.
Carborundum Co.
Norton Abrasives

ENGRAVERS' TOOLS AND SUPPLIES
Chicago Wheel & Mfg. Co.
Metal Crafts Supply Co.

ENVELOPES, Report Card, Commercial, Clasp, Baronial, Catalog
Western States Envelope Co.

EXPOSURE METERS
General Electric Co.
Weston Electric Instrument Corp.

FASTENERS—Staple
Star Paper Fastener Co.

FEEDERS, Automatic (Printing)
American Type Founders Sales Corp.

FILES AND RASPS
Atkins & Co., E. C.
Delta Files
Disston & Sons, Inc., Henry
Heller Bros. Company
Lunsky, White & Coolidge, Inc.
Nicholson File Co.
Plumb Inc., Fayette R.

FILING CASES
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

FILING MACHINES
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Foley Mfg. Co.

FILMS, INDUST. TRAINING
Castle Films
Society for Visual Education, Inc.

FILMS, TEACHING, ETC.
Castle Films
Society for Visual Education, Inc.

FINISHING MATERIALS
General Finishes Sales & Service Co.
Lunsky, White & Coolidge, Inc.

FIRE BRICK AND CEMENT
Chicago Flexible Shaft Co.

FIRE CLAY
Chicago Flexible Shaft Co.

FLASKS
Sterling Wheelbarrow Co.

FLEXIBLE SHAFT AND MOTOR OUTFITS
Walker-Turner Co., Inc.

FLEXIBLE STEEL TAPE RULES
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

FLEXIBLE TUBING AND CONDUITS
General Electric Co.

FLINT PAPER
Behr-Manning Corp.
Carborundum Co., The
Lunsky, White & Coolidge, Inc.
Norton Abrasive

FLOCK & FLOCK GUNS
Paasche Airbrush Co.

FLOOR SANDERS
Porter-Cable Machine Co.

FLUX, SOLDERING
Kester Solder Co.
Ruby Chemical Company

FOLDING RULES
Lunsky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

FOOT PRESSES
Fames Machine Co.

FORGE TOOLS
Stanley Tools

FORGES, Annealing & Melting
American Gas Furnace Co.
Chicago Flexible Shaft Co.

FORGES, GAS
American Gas Furnace Co.
Chicago Flexible Shaft Co.

FOUNDRY EQUIPMENT & SUPPLIES
Brodhead-Garrett Co.
Sterling Wheelbarrow Co.

FREQUENCY METERS Portable and SwRehboard
Weston Electric Instrument Co.

FURNACE LININGS
Carborundum Co., The

FURNACES, Annealing, Case-Hardening, Heat Treating, Metal Melting, Soldering, Tempering
American Gas Furnace Co.
Chicago Flexible Shaft Co.
General Electric Co.

FURNACES, FORGING
American Gas Furnace Co.
Chicago Flexible Shaft Co.

FURNITURE FINISHES AND SUPPLIES
Lunsky, White & Coolidge, Inc.

FURNITURE TRIM
Lunsky, White & Coolidge, Inc.

FUSES, STANDARD
General Electric Co.

GALVANOMETERS
General Electric Co.
Weston Electric Instrument Corp.

GARNET PAPER AND CLOTH
Behr-Manning Corp.
Carborundum Co., The
Lunsky, White & Coolidge, Inc.
Norton Abrasive

GAS-WELDING Equip. & Supplies
Air Reduction Sales Corp.
Linde Air Products Co.

GAUGES, BIT
Lunsky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
Williams & Co., J. H.

GAUGES, CABINET, RULE AND SQUARE
Stanley Tools

GAUGES, CALIPER
Atlas Press Co.
Starrett Co., L. S.

GAUGES, MARKING
Atlas Press Co.
Disston & Sons, Inc., Henry
Lunsky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
Starrett Co., L. S.

GAUGES, THICKNESS AND THREAD
Atlas Press Co.
Starrett Co., L. S.

GENERATOR TEST BENCHES
General Electric Co.
Weidenhoff, Inc., Joseph

GLASS CUTTER
Smith, Inc., Landon P.

GLAZING TOOLS
Smith, Inc., Landon P.

GLUE
Casein Company of America
Franklin Glue Company
Higgins Ink Co., Inc.
LePage's, Inc.
Lunsky, White & Coolidge, Inc.

GLUE POTS, ELECTRIC
Black & Decker Mfg. Co.
General Electric Co.
Lunsky, White & Coolidge, Inc.
Oliver Machinery Co.
Russell Electric Co.
Sta-Warm Elec. Co.
Wallace & Co., J. D.

GOUGES
Lunsky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

GRINDERS AND BUFFERS, PORTABLE ELECTRIC
Baldor Electric Co.
Black & Decker Mfg. Co.
Boice-Crane Co.
Chicago Wheel & Mfg. Co.
Delta Mfg. Co.
Dumore Co., The
Lee Co., K. O.
Lewis Machine Tool Co.
Lunsky, White & Coolidge, Inc.
Precise Products Company
Rivett Lathe & Grinder Corp
Snap-on Tool Corp.
Stanley Electric Tools

GRINDERS, BENCH
Atkins & Co., E. C.
Atlas Press Co.
Black & Decker Mfg. Co.
Boice-Crane Co.
Delta Mfg. Co.
Lunsky, White & Coolidge, Inc.
Mummert-Dixon Co.
Precise Products Company
Snap-on Tools Corp.
Stanley Electric Tools

GRINDERS INTERNAL
Rivett Lathe & Grinder Corp.

GRINDERS, OILSTONE
Mummert-Dixon Co.
Wallace Co., J. D.

GRINDERS, PEDESTAL TYPE
Atlas Press Co.
Baldor Electric Co.
Black & Decker Mfg. Co.
Carter, H. L., Div.,
Delta Mfg. Co.
Lee Co., K. O.
Mummert-Dixon Co.
Porter-Cable Machine Co.
Stanley Electric Tools
Walker-Turner Co., Inc.

GRINDING MACHINES, Plain, Universal, Centerless
Atlas Press Co.
Cincinnati Grinders, Inc.
Precise Products Company

GRINDING WHEELS
Atkins & Co., E. C.
Atlas Press Co.
Behr-Manning Corp.
Carborundum Co., The
Lunsky, White & Coolidge, Inc.
Norton Abrasive

HACKSAW BLADES
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Huther Bros. Saw Mfg. Co.
Lunsky, White & Coolidge, Inc.
Millers Falls Co.
Snap-on Tools Corp.

HACKSAWS
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Lewis Machine Tool Co.
Lunsky, White & Coolidge, Inc.
Millers Falls Co.
Snap-on Tools Corp.
Starrett Co., L. S.

HACKSAWS, Power
Atkins & Co., E. C.

HACKSAWS, POWER BLADES
Atkins & Co., E. C.

HAMMERS
Lunsky, White & Coolidge, Inc.
Millers Falls Co.
Plumb, Inc., Fayette R.
Snap-on Tools Corp.
Stanley Tools

HAMMERS, BALL-PEEN CROSS-PEEN, SLEDGE
Lunsky, White & Coolidge, Inc.
Plumb, Inc., Fayette R.
Snap-on Tools Corp.
Stanley Tools

HAMMERS, BLACKSMITH
Plumb, Inc., Fayette R.
Stanley Tools

HAMMERS, LEAD AND SOFT FACE
Snap-on Tools Corp.
Stanley Tools

HAMMERS, PORTABLE ELECTRIC
Stanley Electric Tools

HAND SAWS
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Lunsky, White & Coolidge, Inc.
Millers Falls Co.

HAND SAWS, PORTABLE ELECTRIC
Stanley Electric Tools

HAND SCREWS
Cincinnati Tool Co.
Lunsky, White & Coolidge, Inc.

HANDICRAFT SUPPLIES
Brodhead-Garrett Co.
Craftsman Supply House
Fellowcrafters, Inc.
Hammett Co., J. L.

HARDIES
Stanley Tools

HEAT-FLOW METERS
Weston Electric Instrument Corp.

HEAT-TREATING EQUIPMENT
American Gas Furnace Co.
Chicago Flexible Shaft Co.

INDICATING INSTRUMENTS, ELECTRIC
General Electric Co.
Weston Electric Instrument Corp.
Weidenhoff, Inc., Joseph

INK REMOVERS
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

INKS, DRAWING AND COLORED
Higgins Ink Co., Inc.
Post Company, Frederick
Weber Company, F.

INKS, PRINTING
American Type Founders Sales Corp.
Driscoll & Co., Martin

JACKETS, SNAP, FLASK, AND MOLD
Oliver Machinery Co.

JACKS, HYDRAULIC
Blackhawk Mfg. Co.

JEWELERS' TOOLS, EQUIPMENT AND SUPPLIES
Chicago Wheel & Mfg. Co.
Fellowcrafters, Inc.
Metal Crafts Supply Co.

JIG SAWS
Boice Crane Company
Brodhead-Garrett Co.
Delta Mfg. Co.
De Walt Products Co.
Disston & Sons, Inc., Henry
Oliver Machinery Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

JOINTERS
Boice Crane Company
Crescent Machine Co.
Delta Mfg. Co.
De Walt Products Co.
Lewis Machine Tool Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Stanley Tools
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

JOINTERS, BENCH
Boice Crane Company
Delta Mfg. Co.
Oliver Machinery Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

JOINTERS, HAND
Atkins & Co., E. C.
Delta Mfg. Co.
Yates-American Machine Co.

KEENE CEMENT
Brodhead Garrett
General Finishes Sales & Serv.

KNIVES, BAND
Burrill Saw & Tool Works

KNIVES, MACHINE
Atkins & Co., E. C.
Burrill Saw & Tool Works
Disston & Sons, Inc., Henry
Huther Bros. Saw Mfg. Co.
Woodworker's Tool Works
Yates-American Machine Co.

KNIVES, PAPER CUTTER
American Type Founders Sales Corp.
Atkins & Co., E. C.
Huther Bros. Saw Mfg. Co.

KNIVES, Sloyd, Linoleum, Leather, Stencil and Wood Carving
Fellowcrafters, Inc.
Lunsky, White & Coolidge, Inc.
X-acto Crescent Products Co., Inc.

KNURLS
Armstrong Bros. Tool Co.

LABORATORY STANDARD INSTRUMENTS
Weston Electric Instrument Corp.

LACQUERS
Campbell Co., M. L.

LAMPS, ALCOHOL
Lunsky, White & Coolidge, Inc.

LAMPS, MINIATURE
General Electric Co.

LAPIDARY TOOLS & SUPPLIES
Elcraft

LATHE ATTACHMENTS
Armstrong Bros. Tool Co.
Atlas Press Co.
Dumore Co., The
Lunsky, White & Coolidge, Inc.
Rivett Lathe & Grinder Corp.
South Bend Lathe Works
Stokes Industries

LATHES, Bench, Metal Working
Atlas Press Co.
LeBlond Machine Tool Co., R. K.
Logan Engineering Co.
Rivett Lathe & Grinder Corp.
Sheldon Machine Co., Inc.
South Bend Lathe Works
Stokes Industries

LATHES, GAP BED
Boice-Crane Co.
Walker-Turner Co., Inc.

LATHES, SMALL PRECISION
Atlas Press Co.

LATHES, SPINNING
Atlas Press Co.
Boice-Crane Co.
Delta Mfg. Co.
Oliver Machinery Co.
Walker-Turner Co., Inc.

LATHES, WOODWORKING
Atlas Press Co.
Boice-Crane Co.
Brodhead-Garrett Co.
Delta Mfg. Co.
De Walt Products Co.
Lewis Machine Tool Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

LEAD AND RULE CUTTERS
American Type Founders Sales Corp.
Rouse Co., H. B.

LEATHER
Lansky, White & Coolidge, Inc.

LEATHER, WORKING TOOLS AND SUPPLIES
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Co.
Elcraft
Fellowcrafters, Inc.
Indianhead Archery & Mfg. Co.
Lansky, White & Coolidge, Inc.
Osborn Bros.
Western Crafts & Hobby Supp.

LETTERS AND FIGURES FOR STAMPING METALS
Atlas Press Co.
Lansky, White & Coolidge, Inc.

LEVELS
Disston & Sons, Inc., Henry
Lansky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
Starrett Co., L. S.

LINOLEUM AND RUBBER BLOCKS AND ENGRAVING TOOLS
American Type Founders Sales Corp.
Chicago Wheel & Mfg. Co.
Lansky, White & Coolidge, Inc.

LINOLEUM, BLOCK CUTTING & PRINTING TOOLS & SUPPLIES
American Type Founders Sales Corp.
Chicago Wheel & Mfg. Co.
Fellowcrafters, Inc.
Lansky, White & Coolidge, Inc.
Western Crafts & Hobby Supp.

LOOM CLAMPS
General Electric Co.

LOOMS
Hammett Co., J. L.

LUMBER
Brodhead-Garrett Co.
Foley Lumber Co., T. A.
Paxton Lumber Co., Frank
Tegge Lumber Co.

MACHINE KNIVES, JOINTER AND SURFACER
Atkins & Co., E. C.
Boice-Crane Co.
Huther Bros. Saw Mfg. Co.
Yates-American Machine Co.

MACHINE LIGHTS
Atlas Press Co.
Boice-Crane Co.

MACHINISTS' TOOLS
Atlas Press Co.
Lufkin Rule Co.
Lansky, White & Coolidge, Inc.
Starrett Co., L. S.

MALLETS, HICKORY, RUBBER, RAWHIDE
American Type Founders Sales Corp.
Lansky, White & Coolidge, Inc.
Snap-on Tools Corp.
Stanley Tools

MANUAL-TRAINING HARDWARE
Lansky, White & Coolidge, Inc.

MANUAL-TRAINING TOOLS AND SUPPLIES
Atkins & Co., E. C.
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Company
Cincinnati Tool Co.
Fellowcrafters, Inc.
Greenlee Tool Co.
Lansky, White & Coolidge, Inc.
Millers Falls Co.
Patterson Bros.
Stanley Tools
Starrett Co., L. S.

MANUAL-TRAINING VISES
Atlas Press Co.
Columbian Vise & Mfg. Co.
Lansky, White & Coolidge, Inc.
Millers Falls Co.
Morgan Vise Co.

MARKING TOOL
Floquil Products, Inc.

MEASURING INSTRUMENTS ELECTRIC
General Electric Co.
Weston Electric Instrument Corp.

MELTING POT EQUIPMENT
American Gas Furnace Co.
Chicago Flexible Shaft Co.
General Electric Co.

METAL CUTTING MACHINES
Continental Machines, Inc.

METAL CRAFT TOOLS AND SUPPLIES
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Co.
Fellowcrafters, Inc.
Metal Crafts Supply Co.
O'Neil Irwin Mfg. Co.
Snap-on Tools Corp.
Stokes Industries

METAL SHEARS, ELECTRIC
Stanley Electric Tools

METAL SPINNING EQUIPMENT
Oliver Machinery Co.

METAL STAMPING MACHINES
O'Neil Irwin Mfg. Co.

METALS, SHEET
Metal Crafts Supply Co.

METRIC SCALES, FLAT
Dietzgen Co., Eugene
Post Company, Frederick

MICA
General Electric Co.

MICROMETERS
Snap-on Tools Corp.
Starrett Co., L. S.

MICROFARAD METERS
Weston Electric Instrument Corp.

MILLING ATTACHMENTS
Atlas Press Co.
Stokes Industries

MILLING MACHINES
Cincinnati Milling Machine Co.
Kearney & Trecker Corp.
Kempsmith Machine Company

MITER BOXES
Atkins & Co., E. C.
Lansky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

MITERING MACHINES, HAND AND POWER (Printing)
American Type Founders Sales Corp.
Rouse Co., H. B.

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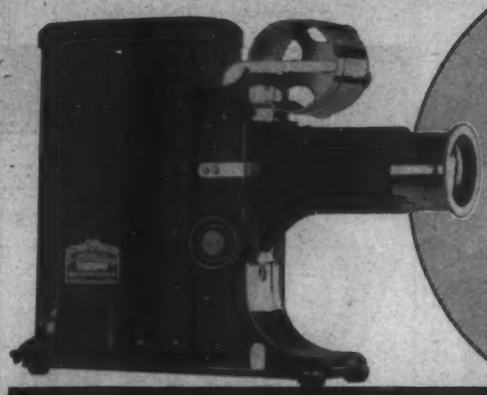

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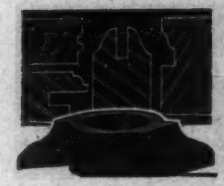

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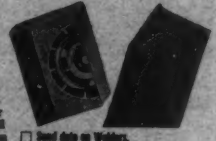

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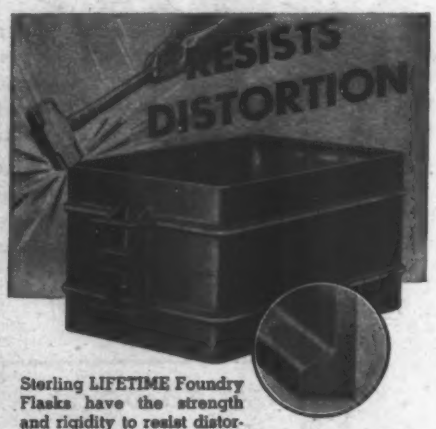

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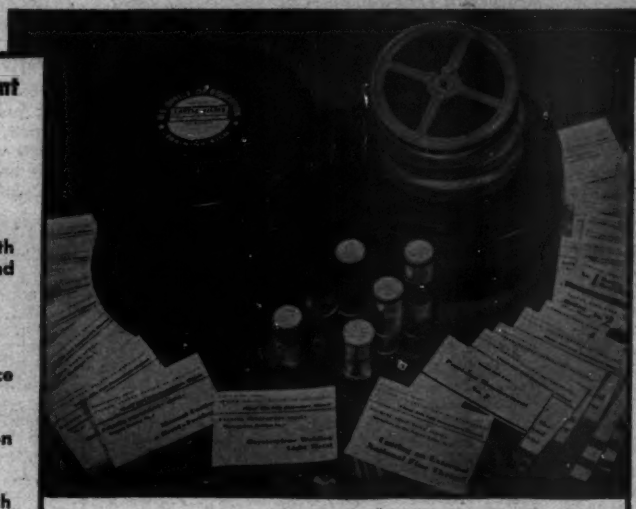

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